



FLAIEC

FINNISH LEARNING ANALYTICS AND
AI IN EDUCATION CONFERENCE

PROGRAMME & ABSTRACTS

September 29th-30th 2022

Joensuu, Finland



UNIVERSITY OF
EASTERN FINLAND

Dear Colleagues,

I would like to warmly welcome you all to the University of Eastern Finland and to our Joensuu campus.

It is our pleasure to host the first FLAIEC 2022, the first Finnish Learning Analytics and Artificial Intelligence in Education Conference! The conference is arranged in Joensuu, Finland, on the 29th and 30th of September 2022. The conference is both on-site and online, and we have had the pleasure of receiving many interesting proposals for the conference. It is also a great privilege to welcome our prominent keynote speakers Professor Dragan Gašević, Professor Sanna Järvelä and Professor Dirk Ifenthaler to the FLAIEC 2022. The keynotes bring topical themes to the conference with viewpoints to the validity of measurements and indicators of learning analytics and perspectives of LA in collaborative learning processes. Professor Gašević will explore the opportunities and challenges for advancement of validity of measurement in learning analytics and build on examples from research on self-regulated learning, teamwork, and language learning. Professor Järvelä will reflect on the regulation of learning in collaborative contexts and introduce the progress of that research and the novel opportunities advanced learning technologies and related data can offer. Professor Ifenthaler will review the promises and opportunities of learning analytics and tackle challenges of implementing indicators into productive higher education eco-systems. Professor Hirsto with OAHOT-research team will present in the keynote some key issues of supporting student learning and teachers' teaching with learning analytics emphasizing the importance of pedagogical perspectives.

The main focus of the conference is on Learning Analytics and Artificial Intelligence to support teaching and learning in all contexts of education. The aim has been to bring together researchers from different countries and various disciplinary traditions to present their research in the field, to discuss the use of them to support learning, and the role of education and educational science in Learning Analytics and Artificial Intelligence. The conference is addressing both junior and senior scholars to present their work.

The presentations in the conference cover a wide variety of perspectives on Learning Analytics and Artificial Intelligence in relation to teaching, learning and education. Papers are related to higher education and primary education as well as vocational education context and explore issues of self-regulated learning, social interaction, learning success and more generally pedagogical designs in relation to utilization of learning analytics and artificial intelligence.

FLAIEC 2022 is organized in collaboration with University of Eastern Finland, OAHOT research project and Learning in Digitalized Society (DIGS) research community. We would also like to thank Joensuu University Foundation for participating in funding of the conference.

We wish you all a nice and fruitful FLAIEC 2022 conference in Joensuu and online!

On behalf of the organizing committee,

*Professor, vice dean Laura Hirsto (UEF), Chair of the FLAIEC 2022
& the OAHOT-team from UEF*

GENERAL INFO

VENUE

The conference takes place at **Aurora building** of University of Eastern Finland. (Yliopistokatu 2, entrance A)

LIVE & ONLINE SESSIONS

Presentations will take place in **AU111** and they will be streamed for online attendees. Live attendees can also watch the stream in adjacent working space AU112 which is available for the attendees during the seminar.

The **Zoom link** will be sent for registered attendees from oahot@uef.fi.

REGISTRATION & BADGES

The registration begins on Thursday 29th September at 9:00 am in Aurora building. You will get your name badge from the registration desk. Please wear your name badge for identification during all conference events & lunches.

LUNCH & COFFEE Thursday and Friday

Buffet lunch will be served for the registered participants in the Aura restaurant, located at the Aurora building. Please, show your conference badge at the counter. A cup of coffee or tea is included with the lunch.

Coffee breaks will take place in the corridor space, in front of AU111.

Special dietary needs indicated in the registration forms have been forwarded to the restaurants (Aura & Kimmel). Please contact the restaurant personnel if you have any questions about special diets.

DINNER Thursday night

The conference dinner is at Original Sokos Hotel Kimmel on Thursday night at 19:15. (Itäranta 1, 80100 Joensuu; near the train station.)

COVID

Only come to the campus when you are healthy, and do not hesitate to rest if you are feeling ill during your trip. If needed, a live presentation can be changed to an online presentation, and the organizing committee will gladly help with the arrangements. The general mask recommendation has been lifted, but masks may still be used according to personal discretion. Masks will be available at the registration table.

TIMEZONE

UTC +3

MORE INFO

sites.uef.fi/flaiec



If you have any urgent matters, please contact the conference secretary Sanna Väisänen:

+358504362264 | sanna.m.vaisanen@uef.fi

PROGRAMME

Wednesday 28th (optional)

8:30-10:00	A visit to the teacher training school. Only for participants that have registered for the visit in advance. The bus transit leaves from Aurora at 8:20
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Thursday 29th

9:00-	Registration desk opens
10:00-10:15	Opening of the Conference – Welcome to FLAIEC 2022 Dean Prof. Janne Pietarinen, Prof. Laura Hirsto, & PhD Sanna Väisänen
10:15-11:00	Keynote 1: Professor Dragan Gašević Monash University, Australia <i>Validity of measurement: We can't ignore it in learning analytics</i>
11:00-12:00	Lunch & coffee
12:00-14:00	Paper Session 1
14:00-14:45	Keynote 2: Professor Sanna Järvelä University of Oulu, Finland <i>Advancing socially shared regulation with AI</i>
14:45-15:15	Coffee
15:15-15:45	Keynote 3: Professor Laura Hirsto & OAHOT Team University of Eastern Finland <i>Possibilities of learning analytics pedagogy to support student learning – multiple case studies</i>
15:45-16:00	Break
16:00-18:00	Paper Session 2
19:15	Dinner at Original Sokos Hotel Kimmel (Itäranta 1, 80100 Joensuu)

Friday 30th

9:00-10:50	Paper Session 3
10:50-11:00	Break
11:00-11:45	Keynote 4: Professor Dirk Ifenthaler University of Mannheim, Germany <i>In search for validity of learning analytics indicators</i>
11:45-12:45	Lunch & coffee
12:45-14:20	Paper Session 4
14:20-14:30	Closing of the conference
14:30-15:00	Coffee (to go)

KEYNOTE 1

Thursday 29th | 10:15-11:00

Professor Dragan Gašević

Monash University, Australia

Validity of measurement: We can't ignore it in learning analytics

The emergence of learning analytics afforded for the analysis of digital traces of user interaction with technology. This analysis offers many opportunities to advance understanding and enhance learning and the environments in which learning occurs. Existing research has shown how learning analytics can provide contributions to different areas of education such as prediction of student success, uncovering learning strategies, understanding affective states, and unpacking the role social networks in learning. While these results have shown much promise, one critical challenge remains unclear – how learning analytics can offer valid measurements of learning processes and outcomes. This talk will explore opportunities and challenges for advancement of validity of measurement in learning analytics. The talk will build on examples from research on self-regulated learning, teamwork, and language learning.

Biography: Dragan Gašević is Professor of Learning Analytics of the Faculty of Information Technology and Director of the Centre for Learning Analytics at Monash University. Previously, he was a Professor and the Sir Tim O'Shea Chair in Learning Analytics and Informatics in the Moray House School of Education and the School of Informatics at the University of Edinburgh (2015-2018) and a Professor and Canada Research Chair in Semantic and Learning Technologies at Athabasca University (2007-2015). He served as the president (2015-2017) of the Society for Learning Analytics Research (SoLAR) and has held several honorary appointments in Asia, Australia, Europe, and North America. His research is focused on computational methods that advance understanding of self-regulated and collaborative learning. He has led and studied systemic adoption of learning analytics in higher education.

KEYNOTE 2

Thursday 29th | 14:00-14:45

Professor Sanna Järvelä

University of Oulu, Finland

Advancing socially shared regulation with AI

There is global consensus that a new set of uniquely human skills and competencies will be necessary to succeed in a rapidly changing world, especially those that machines cannot match or replicate. These skills and competencies are central to research on regulation of learning in collaborative contexts, namely socially shared regulation of learning (SSRL). In this talk I will introduce the progress of that research and what are the novel opportunities advanced learning technologies and related data can offer for SSRL. I stress that systematic understanding of human learning process is needed to leverage full potential of AI to help learners and AI to work and learn together.

Biography: Sanna Järvelä is a professor in the field of learning and educational technology and a head of the Learning and Educational Technology Research Unit (LET). She is the co-chief editor of International Journal of Computer Supported Collaborative Learning (iCSCL) and invited member of the expert group of the OECD's PISA 2025 'Learning in the Digital World'. She has published more than 200 peer-reviewed journal articles. Järvelä and her research group is internationally well known from theoretical advancement of social aspects self-regulated learning (SSRL). Her interdisciplinary research work has strong contribution to the methodological development of process-oriented research methods in the field of learning and collaboration and recently applying of multimodal methods in self-regulated learning research.

KEYNOTE 3

Thursday 29th | 15:15-15:45

Professor Laura Hirsto

University of Eastern Finland, Finland

Possibilities of learning analytics pedagogy to support student learning – multiple case studies

This keynote presents perspectives and findings of the OAHOT-research project, which aimed to draw together and better understand the possibilities to support higher education and primary education students' self-regulated learning and learning processes through the pedagogical use of Learning Analytics (LA). In the primary education students participated in two phenomenon-based study modules, which was designed to support self-regulated learning and reflection skills in a blended learning environment and utilized learning analytics and their visualizations. In the higher education context four courses were built to support online or blended learning with LA tools and visualizations. Students' experiences were mainly positive, but various profiles of using learning environments and LA data as part of it were recognized. Behavioral and emotional experiences seemed to be related, and careful utilization of LA data and tools to support learning may activate even students with a more negative experiences towards the contents of the modules. Also, it seems that students, who used LA data and visualizations more actively, had more favorable experience of them. We also had a larger institution level LA data of vocational education, according to which it seems that teachers' and institutions would need more clearly defined processes for data input to assure the quality of institutional level data. This would require more accurate understanding among teachers of the possible uses of data to support student learning. This keynote will draw together the key insight acquired of the pedagogy of/for learning analytics to support students' learning.

Biography: Laura Hirsto is a Professor of Educational Science in the University of Eastern Finland, Department of Applied Educational Science and Teacher Education. Hirsto is supervising various research and development projects related to academic and educational development, student learning and teacher learning and pedagogical perspectives on learning analytics in various contexts. Her research interests are in higher education students' and teacher students' as well as primary level pupils' learning and motivational processes, and in variations of effective teaching and learning environments. Professor Laura Hirsto is the Project Leader (PI) of the Business Finland funded OAHOT research project (<https://sites.uef.fi/oahot/>). Her keynote will be prepared in collaboration of the OAHOT research project team, and key findings of the project will be presented.

KEYNOTE 4

Friday 30th | 11:00-11:45

Dirk Ifenthaler

Professor, University of Mannheim, Germany

In search for validity of learning analytics indicators

Recent developments in learning analytics, which are a socio-technical data mining and analytic practice in educational contexts, show promise in supporting learning processes and enhancing study success in higher education, through the collection and analysis of data from learners, learning processes, and learning environments in order to provide meaningful feedback and scaffolds when needed. However, an analysis of more than 35,000 publications shows that rigorous, large-scale evidence on the effectiveness of indicators for learning analytics in supporting learning processes and study success is still lacking. This presentation will review the promises and opportunities of learning analytics and tackle challenges of implementing indicators into productive higher education eco-systems.

Biography: Dirk Ifenthaler is Professor and Chair of Learning, Design and Technology at University of Mannheim and UNESCO Deputy Chair of Data Science in Higher Education Learning and Teaching at Curtin University, Australia. His previous roles include Professor and Director, Centre for Research in Digital Learning at Deakin University, Australia, Manager of Applied Research and Learning Analytics at Open Universities, Australia, and Professor for Applied Teaching and Learning Research at the University of Potsdam, Germany. His research focuses on the intersection of cognitive psychology, educational technology, data analytics, and organizational learning. His research outcomes include journal articles, co-authored books, book series, book chapters, and international conference papers. Furthermore, he has grant funding in Australia, Germany, and USA.

SESSION SCHEDULE

SESSION 1

Thursday 29th | 12:00-14:00

LA in higher education and on social interaction

Title	Author/s	
What are they telling us? Accessible analysis of free text data from a national survey of higher education students	Sean O'Reilly Geraldine Gray	Online
Learning Analytics in Moroccan Higher Education: Justifications for use and challenges for successful implementation	Abdelkhalek Zine Abdelali Kaaouachi	Online
How Social interactions kindle productive online Problem Based Learning: an exploratory study of the temporal dynamics	Ramy Elmoazen Mohammed Saqr Matti Tedre Laura Hirsto	Live
A Chatbot-Guided Learning Experience In The Inquiry Science Classroom	Jennifer Davis	Online
Using an automated learning analytics dashboard to capture sentiment in academic asynchronous online discussions	Rogers Kaliisa Jan Arild Dolonen	Live
Flipped Online Approach with Learning Analytics for Supporting Higher Education Students' Learning. Course Feedback Results.	Erkko Sointu Teemu Valtonen Sanna Väisänen Laura Hirsto	Live
Implementing learning analytics into teaching in higher education: teachers' perceptions	Jenni Kankaanpää Sanna Väisänen Laura Hirsto	Live

Chair: Teemu Valtonen

SESSION 2

Thursday 29th | 16:00-18:00

LA in self-regulated learning & among primary level students

Title	Author/s	
Exploring Student Engagement and Self Regulation: A Learning Analytics Approach	Ji Guo Guy Trainin	Online
Same data, different users. How to analyze data and present information for to support both students and teachers	Mari Ahvenjärvi Petri Asikainen	Live
Conceptual and procedural mathematics tasks in ViLLE learning environment	Henri Heiskanen Lasse Eronen Pasi Eskelinen Laura Hirsto	Live
A machine-readable whole child? A critical take on teacher-student relationship and learning analytics	Pekka Mertala	Online
The idiographic paradigm shift needed: bringing the person back into research and practice	Mohammed Saqr Sonsoles López-Pernas	Live
Supporting pupils' reflection with learning analytics during a phenomenon-based study module	Teija Paavilainen Sini Kontkanen Sanna Väisänen Laura Hirsto	Live
How teachers perceive pupils' use of a learning management system and learning analytics visualizations to support their learning?	Sanna Väisänen Laura Hirsto Teemu Valtonen	Live

Chair: Erkko Sointu

SESSION 3

Friday 30th | 9:00-10:50

LA for self-regulated learning & in various learning environments

Title	Author/s	
Measuring Self Regulation a Learning Analytics Approach	Ji Guo Guy Trainin	Live
How do business students self-regulate their project management learning? A sequence mining study	Sami Heikkinen Sonsoles López-Pernas Jonna Malmberg Matti Tedre Mohammed Saqr	Live
Student perspectives on how learning analytics and LMS support self-regulated learning	Susanne Hallberg Sanna Väisänen Laura Hirsto Teemu Valtonen	Live
The use of E-textbooks in higher Education	Guy Trainin Ji Guo	Live
Understanding learners' needs. Exploratively utilized Learning Analytics on students' experiences during blended teamwork process.	Satu Aksovaara Minna Silvennoinen	Live
Mapping students' temporal pathways in a computational thinking escape room	Henriikka Vartiainen Sonsoles López-Pernas Mohammed Saqr Juho Kahila Tuomo Parkki Matti Tedre Teemu Valtonen	Live
Game learning analytics: The case of online educational escape rooms	Sonsoles López-Pernas Aldo Gordillo Enrique Barra Arias Mohammed Saqr	Live

Chair: Mohammed Saqr

SESSION 4

Friday 30th | 12:45-14:20

LA in supporting learning success and pedagogical designs

Title	Author/s	
LMS log activity as a predictor of learning success on an undergraduate Flipped Classroom course of cellular biology	Vesa Paajanen	Live
Disentangling Self-Regulated Learning Patterns to Predict Academic Performance: Evidence from 2 years of LMS panel-data	Tudor Cristea Rianne Conijn Ad Kleingeld Uwe Matzat Chris Snijders	Live
Early detection of dropout factors in Vocational Education: A large-scale case study from Finland	Sonsoles López-Pernas Riina Kleimola Sanna Väisänen Laura Hirsto	Live
Implementing a learning analytics dashboard to support academic advising practice: advisors' information needs and evaluations	Anni Silvola Jenni Kunnari Egle Gedrimiene Hanni Muukkonen	Live
How assessment analytics can help to improve reliability, efficiency, and fairness of entrance examinations	Mika Nissinen Elisa Silvennoinen Mohammed Saqr	Live
A systematic narrative review of learning analytics research in K-12 and schools	Laura Hirsto Mohammed Saqr Sonsoles López-Pernas Teemu Valtonen	Live

Chair: Lasse Heikkinen

ABSTRACTS

Abstracts are in the presentation order. If authors have submitted their abstract to proceedings, the proceedings version of the abstract is included, instead of the original.

SESSION 1

What are they telling us? Accessible analysis of free text data from a national survey of higher education students

Sean O'Reilly & Geraldine Gray

Keywords: Higher education, Student survey, Free text, Machine learning, Unsupervised learning, Clustering, Topic modelling, k-means, LDA

Many staff in higher education have a sense that useful information is buried within their data that they are unsure how to access, or even what questions it can answer. This is particularly so with survey text responses from large student cohorts. This paper examines valid and repeatable methods to analyze such data while seeking to minimize computational and analyst workload by maximizing machine learning to accommodate the large volume of data. We evaluate clustering and topic modelling as methods to analyze one year's data from a national student survey in Ireland, an anonymized dataset with more than 44,700 respondents. The primary focus was on free text responses to two questions, namely those seeking to identify the best aspects of students' reported experiences, and those identifying aspects that need improvement. K-means and Latent Dirichlet Allocation unsupervised learners were used to identify key themes emerging from the text data. K-means proved computationally expensive and failed to usefully categorize significant minorities of the data. In contrast, topic modelling had relatively low overheads and effectively categorized more than 97% of the sample data into themes which could be usefully considered in the business domain. From this research, topic modelling provided an effective method to analyze such text data once careful consideration was given to determining the appropriate initial number of topics for configuring the algorithm.

Learning Analytics in Moroccan Higher Education: Justifications for use and challenges for successful implementation

Abdelkhalek Zine & Abdelali Kaaouachi

Keywords: challenges, Learning Analytics, Moroccan higher education

Learning analytics (LA) is a better solution to leverage the big data left by learners in learning platforms. This solution could become a valuable strategy to increase retention rates, reduce quality disparities, improve resource allocation, monitor skill development, and increase graduation rates. This research explores of the subject of learning analytics in Moroccan Higher Education, in terms of justifications for use and challenges for implementation. The method is based on qualitative research that uses 10 interviews with teachers of polydisciplinary faculty of Nador.

The findings of this research concluded that a small number of professors use on their own initiative learning analytics tools, and their goal was to track the students' work, the development of their performance, and the extent of their commitment. In addition, most respondents mentioned a set of challenges that would need to be addressed if they were to adopt learning analytics, including: inability to align LAs with teacher practices, additional workload and lack of time, concerns about ethics and confidentiality, the results of learning analytics are limited by the value of the data provided, lack of sufficient skills (technological and pedagogical skills), lack of necessary resources (financial and technologies), commitment and adherence of other parties concerned, learning analytics are difficult to operationalize, systemic management of unstructured data, heterogeneity of databases and data, insufficient preparation of teaching staff. A series of recommendations to overcome these challenges were formulated, among the most important of them are: the need for training; the need for advice; the development of policies, models and frameworks for the adoption of learning analytics; the learning analytics tools adopted must be useful and easy to use.

How Social interactions kindle productive online Problem Based Learning: an exploratory study of the temporal dynamics

Ramy Elmoazen, Mohammed Saqr, Matti Tedre & Laura Hirsto

Keywords: Learning analytics, process mining, sequence mining, CSCL, online discussion, problem-based learning

Online computer-supported collaborative learning (CSCL) has risen in popularity in knowledge sharing and problem-solving. This research explored students' online activity in online problem-based learning (PBL) using process and sequence mining approaches. Process mining modeled students' time-stamped activities and links between them. Sequence mining provided an overview of the flow and frequencies of students' activities through sequential process maps. Our finding showed that the most frequent students' activities were non-argument discussions followed by sharing knowledge and social interactions. The process model of the students' discussion started with sharing knowledge most of the time and then students either evaluate or argue others' messages to end discussions through social interactions. The sequence mining model showed that social interaction and non-argument discussion are the most common starting activities by students. It is concluded that process and sequence mining allowed us to identify different stages of online forum discussion in PBL.

A Chatbot-Guided Learning Experience In The Inquiry Science Classroom

Jennifer Davis

Keywords: Chatbot, Natural Language Processing, Biology, Intelligent Tutoring Systems

This presentation describes a practitioner's design-based development of a prototype chatbot to guide students in learning biological concepts of genetic mutations and protein synthesis. Exploration of chatbots in education is still emerging. Chatbots can function as intelligent tutoring systems that interact with students. Winkler & Soellner [1] defined chatbot-mediated learning as synchronous, individualized, student-focused, and usually web-based. Mousavinasab and colleagues [2] documented types of AI techniques commonly used by

education developers and found that most intelligent tutoring systems have been designed for computer science programs, followed by medical sciences and mathematics. Most widely, chatbots are used to give adaptive feedback, hints, or recommendations (Mousavinasab et al., 2021). This chatbot's architecture provides learning activities, feedback, and support throughout a series of short, connected lessons. The chatbot is designed to scaffold learners through a predict, observe, explain model of inquiry learning [3]. It utilizes real-world phenomena to lead students through biology core ideas and incorporates several NGSS science and engineering practices and crosscutting concepts [4]. The researcher presents the design experience from a technologically knowledgeable practitioner's point of view, examining pragmatic challenges and current tools accessible to teachers that may want to explore this type of technology. The discussion includes a report on the three parts of the design process, the preliminary research, development, and prototyping. Design challenges include steep learning curves, tool constraints, and a requisite repositioning of how intents are considered and situated in a bot-led conversation, as opposed to most use-cases in the wider development community. Results of prototype testing include survey results in support of the proof of concept among both students and teachers, as well as accuracy measurements of chatbot intents. Descriptive statistics and suggestions were collected from both groups to evaluate the relevancy, consistency, practicality, and effectiveness of the project as well as speak to improvements for the next iteration of the design. The designer finds that the construction of chatbots as a guided learning experience holds untapped potential in science educational technology.

Using an automated learning analytics dashboard to capture sentiment in academic asynchronous online discussions

Rogers Kaliisa & Jan Arild Dolonen

Keywords: Sentiment Analysis, Asynchronous online discussions, Learning analytics

Educational researchers have pointed to socioemotional dimensions of learning as important in gaining a more nuanced description of student engagement and learning. As highlighted by numerous researchers (Kagklis et al., 2015), emotions are ever-present in education and can dictate many elements of classroom interactions and have long-lasting impacts on motivation and enjoyment. However, to date, only a handful of learning analytics researchers have focused on the analysis of emotions and how they potentially affect epistemic and social interactions in asynchronous online discussions. Yet, there is increasing attention to the need to uncover the many facets of sentiment and emotion from online discourse to gain a more nuanced description of student engagement and learning, as well as an interpretation of the complex dynamics generated during asynchronous online activities. One approach to studying emotion in learning settings is through the natural language processing method, Sentiment Analysis (SA) (Kagklis et al., 2015), which has predominantly been used for analyzing learner affect on course structures, both as an indicator of attrition rate and faculty performance. Few studies to date, consider the connection between sentiment and course content or social dynamic interactions in academic discussions.

To address the question of how sentiment interacts with content and social structures in asynchronous online discussions, we developed an automated teacher-facing learning analytics dashboard here referred to as Canvas learning analytics dashboard (CADA)

(Kaliisa & Dolonen, 2022), which applies a standard SA algorithm called the Valence Aware Dictionary for Sentimental Reasoning (VADER) model (Hutto & Gilbert, 2014). VADER captures both polarity and magnitude of overall sentiment within a text. Posts are considered holistically as documents in the model, and each word contributes to the overall valence. The number of positive, neutral, and negative words are then normalized to yield independent scores, which are aggregated to create the compound sentiment score. The preliminary findings based on VADER showed that negative sentiment is most often associated with course content, especially when students are connecting content to their own personal experiences.

In this presentation, we seek to share our experiences of automating the analysis of sentiment in online discussions using CADA and seek feedback from participants on how to integrate artificial intelligence to improve the algorithm and provide teachers with timely and actionable sentiment insights to support learning design decisions.

Flipped Online Approach with Learning Analytics for Supporting Higher Education Students' Learning. Course Feedback Results.

Erkko Sointu, Teemu Valtonen, Sanna Väisänen & Laura Hirsto

Keywords: Flipped learning, Online teaching, Pedagogy, Learning, Learning analytics, Dispositional learning analytics, Higher education

Using learning analytics and dispositional learning analytics in teaching is difficult. Examples of their use are required for higher educational institutions and teachers. In this paper, we present a flipped learning approach in online settings (due to COVID-19) with particular emphasis on learning analytics and dispositional learning analytics. For this, an understanding of flipped approaches (i.e., flipped classroom and flipped learning) as well as the role of technology in the teaching context is required and presented. The role of technology includes (1) a digital learning system, (2) a conferencing system, (3) the collection and use of learning analytics and dispositional learning analytics, and (4) content-specific technology. Additionally, our aim is to present students' course feedback results from quantitative research methods course practices (2020, 2021) for preservice teachers (i.e., students; N = 70). The content is highly challenging for these students, causing fear, frustration, anxiety, and boredom. Generally, the results for pedagogy were positive, but the results of students' learning perceptions were lower. Based on the approach and results, discussion with new insights is provided.

Implementing learning analytics into teaching in higher education: teachers' perceptions

Jenni Kankaanpää, Sanna Väisänen & Laura Hirsto

Keywords: pedagogical development, blended learning, higher education

During recent years, use of learning analytics (LA) has increased in educational institutions both in administration and teaching, although it has been used and researched for several years (Gašević et al, 2017). In teaching context, LA offers information about students' learning, performance, and actions for both students themselves and teachers (Siemens, 2013). There is a lot of variation in teachers' pedagogical backgrounds and knowledge or use of LA, so starting to use them may require rethinking pedagogy. More knowledge is needed about the use and affordances of LA in blended settings in higher education (van Leeuwen, 2019).

The aim of this case study is to explore implementation of LA and pedagogical planning of higher education teachers, when designing their courses and adding LA tools; how teachers perceive LA, what kind of effects implementation of LA has on pedagogical design work, and what should be taken into account when designing a course and adding LA tools, so that both teachers and students could monitor the progress. Teachers (N=4) with different pedagogical backgrounds of different fields of science from a multidisciplinary university participated in a LA project, during which they designed their courses using blended or flipped learning pedagogical approach. The courses were built on an LMS, and its LA tools and visualizations were utilized in teaching and learning. During the process, teachers received pedagogical and technological support from the research group and peer support from other teachers participating in the project. All the courses included both individual and collaborative activities, class meetings were arranged mostly online. The number of enrolled students varied from 40 to 260. The data of this study consists of teachers' semi-structured interviews, that were conducted after the courses during academic year 2021–2022. The data are analysed by using qualitative content analysis.

The preliminary results show the importance of support in preparing the course; pedagogical, technical, and technological-pedagogical assistance were needed. While the platform as such was considered easy to use, setting up the course and preparing the material there was considered time-consuming; it should be possible to do without taking too much time or personnel. The teachers were interested in having information about their students' learning, but how they used teachers' tools varied. The tools were considered challenging and limited; visualization of students' performance, real-time monitoring, summary functions, and easiness of looking at students' responses, were considered important and something, that would have helped teachers, especially those with larger courses, to better monitor students' learning and activities, and to see what would need more attention. These perspectives should also be considered in pedagogical development work related to LA on different levels of the educational institution; what kind of support and resources teachers may need, what kind of information is needed via LA and how it is used in teaching and learning. Using LA pedagogically actively requires the idea that it works to support students learning, and not as a tool for continuous evaluation of students. The results will be discussed in more detail in the presentation

SESSION 2

Exploring Student Engagement and Self Regulation: A Learning Analytics Approach.

Ji Guo & Guy Trainin

Keywords: Self regulation, engagement, motivation, higher education

Students' daily interaction with the learning management system generates millions of rows of data every day, and the data has tremendous value to expand the understanding of student engagement. Data mining empirical studies rely on students' clicks to study what leads to higher performance, but they fail to explain the processes that govern the relationship between clicks and performance. In addition, past studies have failed in building useful learner feedback loops based on students' digital footprints. This study converted the data from learning traces to latent constructs built on the theoretical framework rooted in cognitive motivational theories. The present study investigated the relationship between student engagement in the learning management system and academic performance.

This study employed the confirmatory composite analysis, a PLS-SEM approach, with 158 participants' data obtained from the learning management system. The present study developed active and passive learning constructs to estimate students' academic performance. The proposed model had a good fit and moderate explanatory and predictive power.

The results of model estimation indicated that students' data obtained from the learning management system was capable of measuring student engagement and predicting performance. Contrary to previous studies, passive learning behaviors were no longer significant after controlling for active learning behaviors. Active learning behaviors were significantly related to academic performance. While self-regulation behaviors were not a significant predictor of academic performance, they had moderate and significant effects on driving both passive and active learning constructs. The total effects between self-regulation behaviors and academic performance were also meaningful.

Same data, different users. How to analyze data and present information for to support both students and teachers

Mari Ahvenjärvi & Petri Asikainen

Keywords: Ensuring the student completes, Using presenting and visualizing data, Learning analytics

Data mining lets us discover patterns, such as how are students actions related to grades. Learning analytics gives us information that can be used to make decisions - information such as students at risk for not completing studies. How can same data be used to support both student and teacher? How can we help teacher and student to share responsibility, what comes to ensuring the student completes his studies?

Typically data collected from student's actions online is used to make predictions about the student's future performance. That is relevant to the teacher. Also, data is typically used to personalize learning platforms by offering suitable content for each student. That can lead the student to a path similar students often pick. But not everyone wants to take the same precalculated path. We want the student to be able to decide by himself – based on reliable

data. Our goal is to provide information for a student to wisely plan studies and monitor the progress.

We also start to collect feedback from students, considering the process on learning. The results are compared to the information about whether a student attended an online course or a classroom course. This can help teachers to offer suitable courses for students.

The data we use: Courses taken - Courses passed - Attendances/ absences - On job learning periods - Feedback. Our goal is to build a simple model, mostly based on quantitative and easy-to-measure data. That being the core. But we are already trying to find ways to combine this numeric data with qualitative factors. First action towards this is collecting feedback. We also want to learn from the others, so much of what we do is somehow related to someone else's findings or researchers. That, for us, is an everyday example of how to use reliable data to perform better. In many ways, we are in the beginning. But as we see it: no one will ever reach the goal or final conclusion. And we are happy to be on this journey of learning.

Conceptual and procedural mathematics tasks in ViLLE learning environment

Henri Heiskanen, Lasse Eronen, Pasi Eskelinen & Laura Hirsto

Keywords: ViLLE learning environment, Mathematics, Conceptual and procedural knowledge

Mathematical knowledge comprises a relationship between conceptual and procedural knowledge. Conceptual knowledge can be defined as a network that links all information about mathematical concepts and procedural knowledge as familiarity with mathematical symbols, rules and procedures used to execute mathematical tasks. Both types of knowledge are important and closely related in the mathematics learning process. To be competent in mathematics students need to meaningfully learn sufficient conceptual and procedural knowledge and can connect them.

Traditional school mathematics typically emphasizes developing students' arithmetic skills. It has been shown that procedural knowledge is not sufficient for successful mathematics education. Emphasis on the development of procedures has gradually shifted to also including other important mathematical proficiency. It is now recognized that conceptual understanding is one of the key mathematical proficiencies. Previous research has shown that strong conceptual understanding has several advantages for mathematics learning, whereas inadequate conceptual understanding can hinder students' mathematics learning and performance.

In Finland, it is common for each student to do exercises in the textbook during mathematics lessons but recently, there has been a growing concern that students' low performance in mathematics partially could be a result of a textbook emphasized instruction. The Finnish national core curriculum for basic education 2014 underlines the significant role of ICT in mathematics across all grade levels. A variety of technologies are being increasingly used in mathematics classrooms and ViLLE learning environment is one of the most common. ViLLE provides learning analytics tools for a teacher to track students' learning. Learning analytics provides a lot of information about the execution of tasks, such as the number of returns and the time spent performing tasks. The environment is also flexible and allows for quick material

updates. Previous studies on MATLOK-project based on ViLLE learning analytics information have shown the conceptual and procedural emphasis of mathematical tasks seems to be related to students' time use and completing tasks. This study has two main research questions:

1. What kind of information do learning analytics in ViLLE environment provide about the mathematics tasks?
2. How conceptual and procedural knowledge is emphasized in the mathematics tasks provided by ViLLE learning environment?

This study analyses learning analytics information and 300 randomly selected mathematics tasks in ViLLE learning environment using conceptual and procedural knowledge-based emphases. Learning analytics allows the teacher to monitor students' work in ViLLE and identify problem areas of mathematics procedures and concepts. On the other hand, the information provided by learning analytics about the learning process in mathematics is insufficient. Analysis of 300 randomly selected mathematics tasks shows that a large proportion of the tasks focus on managing procedural knowledge. Based on the results of the task analysis, this study has produced a package of mathematics problems for grades 3-6 that emphasize conceptual knowledge in the learning environment. Finally, this study considers the specific information of learning analytics in ViLLE learning environment for teacher training and how that information could be used into practice in the future.

A machine-readable whole child? A critical take on teacher–student relationship and learning analytics

Pekka Mertala

Keywords: I-It, Martin Buber, Dialogical philosophy, Learning analytics, Datafication, Automation, Teacher-student -relationship

This conceptual presentation asks what intensifying datafication and automation of education mean for teacher–student -relationships by using learning analytics as a practical example. Theoretically, the paper draws on Martin Buber's (1937) ideas of the dialogical I–Thou and objectified I–It as the key forms of human relationships. In the I–Thou relationship, subjects meet one another in their authentic existence, without any objectification of one another. In the I–It relationship, the other is objectified as a mental representation, created and sustained by the individual mind. Datafication and automation bring new perspectives to Buber's ideas, especially to the I–It relationship. Today, the representation of a student is no longer created and possessed (only) in the mind of an individual (here, the teacher), but also through and as data points that are (automatically) analyzed and visualized via different (often interlinked) platforms.

My core argument is that increasing datafication and automation steers the teacher–student relationship towards an objectified I–It relationship instead of the dialogical I–Thou relationship, which Buber (and others such as Gert Biesta, another main influencer of the presentation) saw as the ideal. Via this argument, the presentation will provide a counter-narrative for the positively oriented views on digital disruption of education. Put differently, commonly-made bold statements such as “learning analytics holds the potential to transform the way we learn” (Baer and Norris, 2017) are plausible only if the undesired I–It relationships are included among the possible forms of transformation.

The idiographic paradigm shift needed: bringing the person back into research and practice

Mohammed Saqr & Sonsoles López-Pernas

Keywords: learning analytics, idiographic, within-person

Personalizing, adapting, self-directedness, self-regulation, autonomy, and self-control – inter alia– have all been around for decades. As close – in concept as they might seem – often overlapping or differing according to scholarly traditions, as elusive were they to assess or achieve. As we currently stand, we are not short of theories around such constructs, or methods to achieve them given the vast amount of theories and meta-analyses of intervention that “should work. Yet, our quest to bring real changes on the ground has so far fell short of promise or aspirations. The reason for such not as expected results pertains to dissonance between how research is conducted, assessed or applied. While such constructs embrace the quintessential element of “self” or “person” as a central point of departure from existing methods or theories. Research is conducted by using data from other persons to derive generalizable laws or norms that we aim to characterize or intervene according to their inferences. Nonetheless, such data collected from others, are barely – if at all does – represent any single person, ergo a paradigm shift is needed to bring the very person into our approach to research and practice. This presentation aims at introducing person-based methods, show the importance thereof in assasin students’ learning behavior, inferring person-based intervention methods, and understand person-based behavior.

Supporting pupils’ reflection with learning analytics during a phenomenon-based study module

Teija Paavilainen, Sini Kontkanen, Sanna Väisänen & Laura Hirsto

Keywords: elementary school pupil, self-regulated learning, learning analytics, reflection

Self-regulated learning (SRL) (Zimmerman, 2002) is a core skill in future learning and society. Pupils’ skills to regulate their own learning are becoming a more relevant learning object already at elementary school. Understanding and evaluating pupils’ SRL actions is, however, challenging (Roll & Winne, 2015). When learning in a digital learning management system (LMS), pupils leave traces of learning, such as visiting the LMS and returning the assignment. These important traces describe their SRL (Roll & Winne, 2015). Therefore, implementing learning analytics (LA) in an LMS could help to understand and support SRL.

A recurring element of SRL is reflection. As in Zimmerman’s model of SRL (Zimmerman & Schunk, 2011) reflection is the phase of learning when pupils evaluate their activities in relation to their objectives and determine the objectives and strategies for future. In this study, to support SRL, we embedded reflection in an LMS, as a part of the learning design. The context was a phenomenon-based learning (Symeonidis & Schwarz, 2016) module wherein pupils, as active producers, collaborated with others and created learning artefacts. This study module was realized in blended circumstances, with digital learning environments strongly utilized. The research aim was to explore how learning analytics could support elementary school pupils’ reflection and SRL in collaborational phenomenon-based learning.

This research was conducted with 89 5th-6th grade pupils, aged 10-12, in a Finnish elementary school. Data was gathered as a part of the learning process, through the LMS. Data consisted of pupils' reflections during the study module and learning analytics data from the LMS.

Qualitative data, from open-ended reflections, underwent content analysis, to form groups of different levels of pupil reflection. A four-level scale of pupils' reflections was formed based on the reflection levels of Fleck and Fitzpatrick (2010). According to preliminary results, pupils about the same age have very heterogeneous skills in reflection. A minority could perceive a change in their knowledge or skills during the learning process, highlighting a higher level of reflection. Some recognized the influence of surroundings (group, subject, mood) on their learning. Almost half were at the lower levels of reflection, i.e. being able to describe what they had done and what they had learned. According to preliminary results, the level of reflection was higher at the end of the study module. In addition, the type of the assignment made a difference on reflection level. The next phase is to compare pupils' reflection levels to LMS log-data.

How teachers perceive pupils' use of a learning management system and learning analytics visualizations to support their learning?

Sanna Väisänen, Laura Hirsto & Teemu Valtonen

Keywords: learning analytics visualization, learning management system, elementary school pupil, elementary school teacher, self-regulated learning

In technology-enhanced learning environments, technology-based scaffolds can offer support for students but also provide opportunities for teachers to focus on more customized scaffolding (Sharma & Hannafin, 2007). For example, learning analytics (LA) is suggested to provide efficient ways to support self-regulated learning (Ifenthaler & Schumacher, 2016). This study aimed to explore, how teachers perceive pupils' utilization of a learning management system (LMS) and LA visualizations to support their self-regulated learning and studying. The study was performed during face-to-face lessons where teachers guided pupils' learning through the LMS in the year of 2021. Altogether, four 5th and 6th grade elementary school teachers were interviewed twice with semi-structured interviews. A qualitative content analysis was performed.

Preliminary results suggest that teachers highlighted the clear structure of the LMS as a factor that supports learning. The LMS acted as a ladder and a guidance for learning. Furthermore, the structure of the LMS supported mainly self-regulated learning. Self-directed pupils performed well, whereas those with problems with regulating their own learning and behavior had problems working on LMS as well. There was variation in how much pupils followed their own learning and progress through LA visualizations. Self-directed learners followed their own progress rather actively. Others did not and furthermore, did not seem to focus on what they were studying. Instead, they just clicked their way through the tasks. Hence, teacher support was seen to be relevant in addition to the support provided by LMS and LA.

SESSION 3

Measuring Self Regulation a Learning Analytics Approach

Ji Guo & Guy Trainin

Keywords: self-regulation, analytics, information processing

This study describes how using learning analytics only, instructors, designers, and learning analysts can reliably and validly measure self-regulation of learning. This approach to learning analytics is based on a careful analysis of the literature deriving theory and empirically validated constructs to drive analysis instead of more commonly data mining approaches. We believe that using such approaches can help the field move forward.

Self-regulation, an important facet of school success, is the control of cognition and behavior (Boekaerts et al, 1999). Hattie (2008) identified such metacognition as one of the most powerful predictors of achievement. Boekarts (1997) further claimed that many students are not self-regulated learners during their K12 years. Cohen (2012) showed that many of these students struggle with self-regulation even when they reach college. Williams and Hellman in their study of first and second-generation college students in an online environment showed that first-generation students reported significantly lower levels of self-regulation for online learning than their second-generation counterparts.

The traditional approach to measuring self-regulation and learning behaviors usually requires resource-intensive methods but suffers from high costs, long time, and sometimes unreliable and invalid self-reported data. Measuring self-regulation and active and passive learning behaviors with data easily collected while maintaining good reliability, validity, and predictability to academic performance could be very beneficial. We utilized students' digital footprints from the learning management system to model student engagement and measure self-regulation and learning behaviors. By employing the partial least square structural equation modeling, we moved from a data mining approach to constructs in an organized and theory-based approach to address epistemological, pedagogical, and assessment challenges suggested by Knight and Shum (2017).

We incorporated active and passive learning behaviors, and self-regulation as constructs of student engagement to investigate their relations with students' performance. The results showed the potential of students' digital footprints to assess self-regulation without adding any measurement burdens. The measurement of behaviors, performance, and self-regulation was reliable and valid, and the model had moderate exploratory and predictive power. About 65% of the variance of performance was explained by self-regulation and active learning behaviors, but only marginally by passive learning behaviors. Self-regulation had no significant direct effects on performance, but its indirect effects via other behavioral constructs on performance were significant and positive, suggesting that self-regulation drives both passive and active learning behaviors.

How do business students self-regulate their project management learning? A sequence mining study

Sami Heikkinen, Sonsoles López-Pernas, Jonna Malmberg, Matti Tedre & Mohammed Saqr

Keywords: Sequence mining, micro-level SRL processes, learning tactics, academic achievement, learning analytics, project management

The relation between learning strategies and academic achievement has been proven to be strong in multiple studies. Still, the connection between micro-level SRL processes and the academic achievement of business students in learning project management remains unstudied. The current study aims to find how sequence mining can identify students using different learning tactics and strategies in terms of micro-level SRL processes. Our findings show that there are differences in the use of tactics and strategies between low and high performing students. Understanding the differences in how low and high performing students apply different micro-level SRL processes can help practitioners identify students in need of support for SRL.

Student perspectives on how learning analytics and LMS support self-regulated learning

Susanne Hallberg, Sanna Väisänen, Laura Hirsto & Teemu Valtonen

Keywords: learning analytics visualization, learning management system, self-regulated learning, higher education students

Utilizing self-regulated learning (SRL) strategies, including planning, goal setting, and self-evaluation, seem to play a major role in student's academic success (Zimmerman, 2013). Learning analytics (LA) visualizations potentially support these skills by making student's progress observable, and enabling data-based decisions; however, more research of LA visualizations and learning management systems (LMS) is needed to identify the elements, that support students' diverse self-regulation needs (Schumacher & Ifenthaler, 2018). Furthermore, SRL skills seem to influence, what LA visualizations students consider relevant and meaningful – but research on this topic is still scarce, especially in higher education context (Jivet et al., 2020). The aim of this study is to examine how higher education students perceive the utilization of LA and an LMS from the perspective of self-regulated learning, and further, what kind of LA visualizations and LMS features could support their SRL.

The participants were students from a Finnish university, from various disciplines and courses. Courses were arranged fully or mainly online and utilized an LMS that tracked and visualized student's progress via LA. Course materials were gradually opening modules, which included learning goals, video and text materials, and tasks, e.g., questionnaires and/or teacher evaluated assignments. Altogether, 14 students participated semi-structured theme interviews after the courses, during 2021. The data was analyzed with qualitative theory-guided content analysis method.

Preliminary results suggest, that introduced learning goals and gradually opening materials helped some students to orientate and schedule their studying and set their own goals. Most

of the students were not used to this kind of goal setting. One student was orientated to deep learning when the course started, but after realizing the massive workload, changed their goal to mandatory course material completion. The modular and gradual structure of the LMS supported this prioritizing process.

Completion marks on completed modules were mainly considered useful and rewarding in independent progress tracking. Sometimes a teacher used the modules for presentation during teaching sessions. Regardless their attendance, the students had to browse the same materials through to complete the module, which was unmotivating.

Students considered automatic feedback from questionnaires mainly useful for assessing their knowledge level and gaps. The feedback motivated some students to study and practice more, and some utilized the questionnaires unprompted while preparing to exam. However, increased awareness of knowledge gaps was also discouraging for some students. Further, gradually given, teacher-evaluated assignments helped internalization of materials, when compared to extensive assignments in some other courses. This, however, required teachers prompt feedback to support self-regulative learning.

Clear, modular structure, and gradually opening materials were considered to support independent studying, staying on schedule, and managing the workload. However, some students would have preferred to access all materials at once and regulate their own pace. In future research, we aim to supplement these qualitative student experiences with learning analytics data that has been collected from the LMS. This data includes student activities and the use of learning materials.

The use of E-textbooks in higher Education

Guy Trainin & Ji Guo

Keywords: e-txtbook, learning analytics, higher education

More than 84% of American undergraduate students had some or all of their courses moved to online-only instructions due to the COVID-19 pandemic (NCES, 2021). The pandemic also accelerates trends of digitalization and technology integration into course work and course delivery. This study explores the ways the pandemic accelerated patterns of integrating digital resources and affordances into higher education. In particular, this study examines the changes in the usage of e-textbooks by instructors and students, highlighting the trends in e-textbook usage as higher education enters a new era of course delivery.

Empirical studies showed a decreasing trend in reading compliance in the past 40 years regardless of discipline and for many decades. Burchfield and Sappington (2000) found that only 20% of students met the reading compliance for any given reading in the late 1990s, which decreased from 80% in the early 1980s. Podolefsky and Finkelstein (2006) noticed that fewer than 15% of students read less than 15% of assigned readings before class. Baier, Hendricks, Gorden, Hendericks, and Cochran (2011) surveyed 395 students and found that 89% of students believed they are able to obtain a C or better grade without reading any assigned textbooks. Classroom discussions, mastery of content, and appreciation of lectures could be diminished if students fail to complete reading assignments (Sappington, Kinsey, & Munsayac, 2002). However, there is a limited number of studies exploring how students use textbooks during the COVID-19 pandemic, especially under the situation that most courses moved to online-only instructions.

This study implements a learning analytics approach with textbook reading data obtained from the information systems to examine how students' reading behaviors changed before and during the COVID-19 pandemic. Practically, this study benefits course instructors on choosing the best strategies to promote reading as a common frustration for university instructors is getting students to read textbooks. Theoretically, this study investigates the relation between student's self-regulated learning behaviors and reading behaviors, providing a evidence-based approach to the impacts of self-regulated learning behaviors on other behaviors.

Understanding learners' needs. Exploratively utilized Learning Analytics on students' experiences during blended teamwork process.

Satu Aksovaara & Minna Silvennoinen

Keywords: Explorative Learning analytics, Student experiences, Blended teamwork, UAS students, Self-efficacy

We combined learning design and data collection to utilised Learning Analytics through reflective learning tasks during the blended learning process. Self-efficacy beliefs in relation to course satisfaction and blended learning elements we explored. Exploratively utilized Learning Analytics deeper understanding of learners' needs and offers tools for developing learner-centred blended learning courses.

Mapping students' temporal pathways in a computational thinking escape room

Henriikka Vartiainen, Sonsoles López Pernas, Mohammed Saqr, Juho Kahila, Tuomo Parkki, Matti Tedre & Teemu Valtonen

Keywords: Computer science education, Educational escape rooms, Teacher education, Collaborative learning

This case study explored the applicability of sequence mining and process mining methods on qualitative video data of a group-based problem-solving situation. For the case study, audio and video data were collected from a pilot experience of an educational escape room, which was designed to practice the application of computational thinking (CT) skills. The escape room combined digital and physical affordances into CT puzzles and challenges. To examine processes and patterns of collaborative learning and problem-solving in the context of the CT escape room, video data from pre-service teachers' game activities were collected. A unique contribution of this case study is that it demonstrates how sequence and process mining methods can be applied to a type of qualitative content analysis often found in research on collaborative learning.

Game learning analytics: The case of online educational escape rooms

Sonsoles López-Pernas, Aldo Gordillo, Enrique Barra Arias & Mohammed Saqr

Keywords: learning analytics, game learning analytics, educational escape rooms, dashboard, game-based learning

Educational escape rooms are team-based learning activities in which students solve puzzles related to a certain subject to accomplish a final goal (usually escaping from a room). These activities have proven capable of increasing students' knowledge in a variety of subjects and contexts while improving motivation and engagement. A key characteristic of educational escape rooms is that they are time-constrained. Therefore, if students do not complete all the puzzles in time they will not gain exposure to part of the learning materials in the activity. As such, it is crucial to provide timely support to students to prevent them from getting stuck and frustrated, and ensuring they progress through the activity. However, providing such support can be challenging for instructors since they often have to monitor several students at the same time, which becomes even harder in online teaching environments. The Escapp platform provides a solution for this challenge. Escapp is a web platform that allows to conduct online educational escape rooms. Besides providing all the features needed for instructors to set up their escape rooms both online or face-to-face, Escapp provides a learning analytics dashboard that allows to closely monitor students while they play, enabling the detection of lagging players and the provision of hints to help them advance through the escape room. The Escapp platform has been used to conduct several escape rooms at Universidad Politécnica de Madrid where the learning analytics dashboard has been used to detect lagging students and to optimize the game design. In this presentation, we will show an example of one of these educational escape rooms and how the learning analytics dashboard has played a crucial role in the correct development of the activity. We will discuss current and potential uses of the dashboard and of the data collected from the students. Our goal is to offer an innovative perspective on learning analytics and how they can be adapted to the specific learning scenario of educational escape rooms.

SESSION 4

LMS log activity as a predictor of learning success on an undergraduate Flipped Classroom course of cellular biology

Vesa Paajanen

Keywords: learning analytics, higher education, Log activity, flipped classroom, self-regulated learning

Monitoring student activity in learning management system (LMS) can provide useful information for learning design, student support, and development of LMS analytical tools. This study used LMS log information to detect the elements which help students to reach their learning goals in a flipped classroom course of bioscience, identify students' time management difficulties, and develop tools to detect students with risk of drop out during the course.

A traditional lecture course of bioscience was modulated into flipped classroom, and Moodle activity of 100 voluntary student was analyzed in the study to reveal the potential pitfalls of the course structure. Effectiveness of course content to increase learning success was tested with pair-wise comparisons, variance analyzes and best subset regression. Although in general, the students were able to reach the learning goals better after the modulation, LMS log information revealed several challenges in self-regulated learning. The learning activity of the students with high drop-out/failure risk was highly periodical, for which 25 % of their LMS use was happening in a single day of 7-week course. Beside the time management challenges, use of elements of resources and supportive mechanisms affected course passing and grading statistically significantly. These parameters were together able to predict the learning success ($R^2 = 0,645$) much better than student's earlier studies or main study subject. Interestingly, detail analyses of single elements revealed small but significant, nonlinear effects of self-evaluation and external www-links for low and high-grade students, respectively. LMS use of students at-risk was significantly different already during the first week of the course, which indicate high possibilities of learning analytics to identify students who need help during the course.

Disentangling Self-Regulated Learning Patterns to Predict Academic Performance: Evidence from 2 years of LMS panel-data

Tudor Cristea, Rianne Conijn, Ad Kleingeld, Uwe Matzat & Chris Snijders

Keywords: self-regulated learning, pattern analysis, multi-modal data

Background: Learning management systems (LMSs) offer the potential for blended learning, allowing learners to study (partly) online at their own pace and ability. However, this also makes the capability to self-regulate their own learning processes essential for effective learning. The COPES model, developed by Winne and Hadwin in 1998, is a theoretical framework for studying SRL in the online environment. Our study explores the SRL concept through the COPES model, using both clickstream and survey data. Our research question is: What is the extent to which SRL micro-processes within the COPES framework, generated from trace data, can be used as events in sequential pattern analysis in order to predict academic performance of students?

Method: We collected clickstream data from the Canvas Learning Management System for 2 years for 64 courses from one faculty. In total, 48 indicators were identified that relate to the

four different phases of COPES: task definition, goal setting, study tactics, and adaptation. While previous studies have formed indicators for SRL, as far as we know, none have done so for the separate stages that are part of the COPES model. This offers more depth and specificity for the processes behind SRL than most other models and it is designed specifically for the online environment. This allows us to follow the dynamic processes that students go through when self-regulating online, also because our data allows us to follow students over time both within and between courses. Second, we use Hidden Markov Models (HMM) to analyze our data, where a HMM state is defined as a session in which some part of SRL has been completed by a student. We then cluster the students around these (patterns of) HMM states. Subsequently, we use the clusters to predict the grades of students.

Results and conclusion: We are currently running our analyses, but preliminary correlational results suggest that the indicators regarding students' access to teacher announcements, discussion forums, and general inactivity are most predictive of academic performance. We plan to complete the analyses over summer. We do see that the panel nature of the data allows for more extensive and rigorous analyses than is possible with "just" single-course or even cross-sectional data.

Early detection of dropout factors in Vocational Education: A large-scale case study from Finland

Sonsoles López-Pernas, Riina Kleimola, Sanna Väisänen & Laura Hirsto

Keywords: vocational education and training (VET), dropout, learning analytics, prediction

The aim of this study is to analyze which factors from students' admission data can predict dropout in initial vocational education and training (VET) in Finland. Admission data from students in different fields of VET that started an initial VET between 2014 and 2021 in a large-size vocational school in Finland were used. The sample included a total of 15,523 students. The results of fitting a logistic regression model to the admission data showed that students who started a VET program after basic education were more likely to drop out, as well as students who combined their studies with a job or job-seeking. Our findings pave the pathway for further research to implement support measures for decreasing dropout that are tailored to each specific "risk group".

Implementing a learning analytics dashboard to support academic advising practice: advisors' information needs and evaluations

Anni Silvola, Jenni Kunnari, Egle Gedrimiene & Hanni Muukkonen

Keywords: academic advising, stakeholder involvement, higher education

Current research has identified academic advisors as an important stakeholder group of developing and using learning analytics (LA) tools and practices. With the provided LA tools, advisors are able to monitor students' progression, use visualizations as a mediation for the student-advisors dialogue during advising meetings, support students' academic decision-making, follow predictions of student performance and retentions, and make informed decisions about needed support and interventions (Charleer et al., 2018; Hilliger et al., 2020).

Engaging all stakeholders actively for the development and implementation process of LA tools is important in order to develop relevant and reliable LA tools (Chatti et al., 2021). Our study describes a development process of a learning analytics dashboard (LAD) for academic advisors. We set following research questions to identify the key support aspects, advisors' information needs, and their evaluations of the developed LAD as a support for their advising practice:

What academic advising practices emerged during the pandemic?

What kind of possibilities and challenges did the academic advisors identify in utilizing LAD in remote advising?

How did the academic advisors experience the LAD ?

The developed dashboard included two visualizations of students' personal study plan: bar plot and radar plot. The visualizations included information about the selected courses, students' progress and success during the selected study year, and comparison information for the progression of the peers in the same study year. The dashboard utilizes existing study-registry data.

We conducted a set of workshops for academic advisors to better understand emerged practices and experiences of academic advising during the pandemic, and a pilot study in which academic advisors tested the dashboard as a mediating tool for academic advising meetings with students. We collected data through focus group interviews (N=18) and questionnaires including likert-scale questions and open-ended questions (N1=11, N2=32). These data provided us an important overview of advisors' practices, information needs and their evaluations of the developed LAD. Results indicate that the LAD can take different roles in advisors' work, helping to prepare for the advising sessions, mediate the interaction with students, helping to follow students' progression during the academic year and identifying students who need to be contacted further. However, advisors also identified challenges in interpreting the visualizations and outlined further information needs. Advisors evaluated the dashboard more useful for preparation and monitoring than as an intervention prompt. The preliminary results provide valuable understanding about the ways how existing educational data can be utilized effectively to support academic advisors. The theoretical perspectives for LA supported academic advising will be discussed.

How assessment analytics can help to improve reliability, efficiency, and fairness of entrance examinations

Mika Nissinen, Elisa Silvennoinen & Mohammed Saqr

Keywords: Assessment analytics, entrance examine, multiple choice question

The study examined the level of difficulty, discrimination, and reliability of multiple-choice questions [MCQs] in Finnish national Law entrance examinations. The purpose was to assess whether MCQs could be used to rank applicants in a sufficiently reliable manner. The data set consists of anonymized scores from three exams (years 2018, 2019, 2021) containing 11,201 applicants all together. The study found that the MCQs provide a reliable, adequate, and high-quality discrimination. MCQ scores were also shown to correlate with essays and total scores.

A systematic narrative review of learning analytics research in K-12 and schools

Laura Hirsto, Mohammed Saqr, Sonsoles López-Pernas & Teemu Valtonen

Keywords: learning analytics, K-12, elementary school, literature review, educational data mining

The field of learning analytics emerged in the last decade to take advantage of the increasing availability of data about learners that digital systems generate. Existing research in learning analytics has focused on higher education, as this context often relies heavily on digital platforms such as online learning management systems, making data collection easier. In this paper, we focus on LA research in the context of elementary level teaching. We provide a systematic narrative review in which we analyze the articles that had the most impact in the field. Our results show the existence of some recurring themes such as gamification and multimodal methods. We make a distinction between papers in which learning analytics is the target of the study (e.g., dashboards) and papers in which learning analytics methods were used as a means to study a given behavior/skill/phenomenon (e.g., problem-solving skills). Lastly, we found that most studies lack a strong theoretical foundation on education science and, thus, there is a need to develop more elaborated theoretical perspectives in future research on school-level learning analytics, as well as papers that deliver a real impact on learning and teaching.

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