

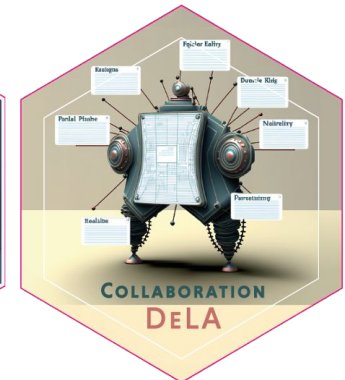
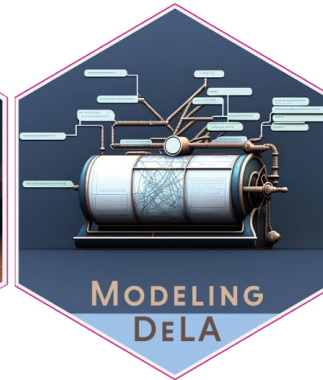
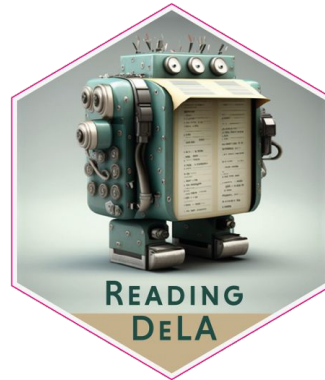
# Theses topics in the area of Education Technologies

Provided by

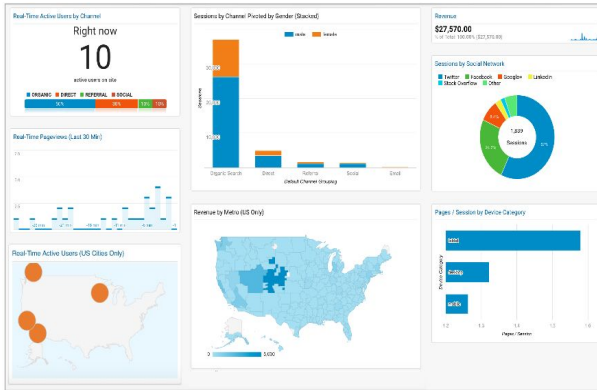
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Educational Technologies at DIPF

# Category 1: Highly-Informative Learning Analytics



# [1.1] [DEV] Learning Analytics Dashboard



## Suitable for:

Bachelors & Masters

## First examiner (Betreuer):

Prof. Dr. Hendrik Drachsler

## Mentor:

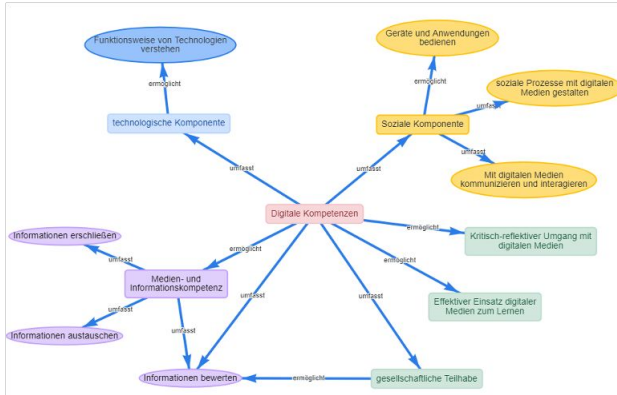
[Atezaz Ahmad](mailto:a.ahmad@dipf.de), <a.ahmad@dipf.de>

**Background.** Learning Analytics Dashboards (LADs) provide users with insights about their study progress and an overview of the system through visualizations. LADs consist of metrics and indicators. Metrics are the unit of measurement (e.g. number of views/courses, total keywords/resources, keywords frequency, etc.). We refer to this unit of measurement as metrics. Metrics are used to create indicators; an indicator is the result of the analysis of one or multiple metrics and gives a more comprehensive picture of a particular abstract, e.g. course analytics, self-reflection, engagement, etc.

**Task.** The task is to develop a learning analytics indicators dashboard (e.g., [link](#)) that provides an overview of the platform. An extensive JSON dataset will be provided, which contains over a million courses. The dashboard should be able to give a complete overview of the system. The visualization like course analytics (numbers), worldcloud (keywords and course description), and course distribution by location (country and cities) for example [link](#).

**Skills.** Javascript, HTML, and visualization libraries like highcharts, echarts, d3, or c3js can be used. The mentioned libraries and languages are not mandatory to be used. You can use any other programming language or technology.

# [1.2] Learning Analytics for MindMap-Tools



**Background.** The integration of Learning Analytics into Learning Management Systems, especially Moodle, offers significant potential for improving learning success through formative feedback. Despite the increasing use of MindMap tools as didactic resources in Moodle, efficient strategies for analyzing the generated process data are lacking. This gap hinders the provision of precise, implementation- and content-oriented feedback, which is essential for individual learner support.

**Task.** The aim is to address this challenge by developing specific data identification strategies and thus contribute to optimizing the use of Learning Analytics in educational technology.

## Suitable for:

Masters

## First examiner (Betreuer):

Prof. Dr. Hendrik Drachslar

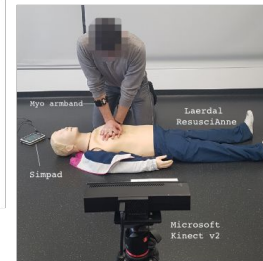
## Mentor:

Tornike Giorgashvili

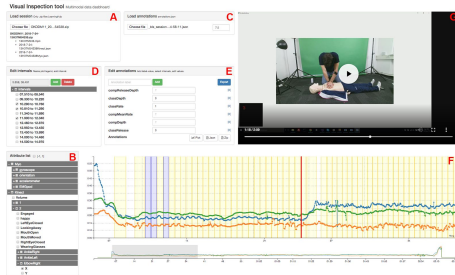
(giorgashvili@studiumdigitale.uni-frankfurt.de)

**Skills.** Basic knowledge in the field of e-learning and a fundamental familiarity with Learning Management Systems, especially Moodle, are required. Also necessary are basic skills in data analysis and processing, preferably with experience in using database management systems such as MongoDB. Knowledge in the development and application of Learning Analytics or similar data-driven analytical methods in the education sector is advantageous but not mandatory.

# Category 2: Multimodal AI for automated feedback



## [2.1] Integrated Visual Inspection Tool



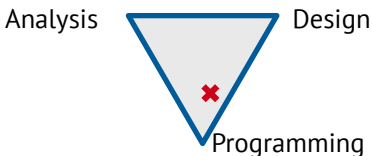
**Background.** The Visual Inspection Tool (VIT) is a web-based tool developed in Javascript and HTML5, which allows the visual inspection and the annotation of multimodal datasets encoded with MLT-JSON data format. In the VIT, the expert can load the session files one by one to triangulate the video recording with the sensor data. The user can select and plot individual data attributes and inspect visually how they relate to a video recording. The VIT is also a tool for collecting expert annotations. In the case of CPR Tutor, the annotations were given as properties of every single chest compression.

**Suitable for:** Bachelors & Masters

**First examiner (Betreuer):**  
Prof. Dr. Hendrik Drachslar

**Mentor:** Dr Daniele Di Mitri,  
<d.dimitri@dipf.de>

**Evaluation:** Design-driven evaluation



**Research Task.** The VIT is meant to be used with the Multimodal Learning Hub. The VIT is able to load the MLT-JSON format. In its 2.0 version, the LearningHub is evolving its data format. This research task consists in using re-engineering the VIT to have it an integrated tool on a Django web-server.

### Resources:

- Github Repository of the VIT <https://github.com/dimstudio/visual-inspection-tool>
- Research paper about the VIT: Di Mitri D., Schneider J., Specht M., Drachslar H. (2019) Read Between the Lines: An Annotation Tool for Multimodal Data for Learning. In Proceedings of the 9th International Conference on Learning Analytics & Knowledge - LAK19 (pp. 51–60). New York, NY, USA: ACM. DOI: [.10.1145/3303772.3303776](https://doi.org/10.1145/3303772.3303776)

## [2.2] Training oral presentation skills with motion capture



**Background.** In the context of the HyTea project ([www.hytea.de](http://www.hytea.de)), we are developing a Presentation Training software called “Presentable” which provides automatic feedback to the presentation style of the presenter, both looking at the verbal and non-verbal communication. The software is designed as client-server web application.

**Research Task.** There are various open tasks in this topic:

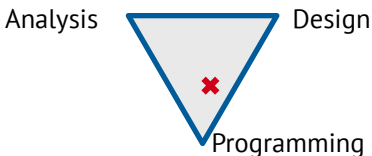
- (1) developing a teacher dashboard (Alignment dashboard) where each session recorded with Presentable can be loaded and watched by the teacher afterwards;
- (2) privacy preserving speech detection – to avoid sending the audio data to external libraries;
- (3) collecting a dataset of typical poses in the presentation and train a machine learning model which is able to recognise them;

**Suitable for:** Bachelors & Masters

**First examiner (Betreuer):**  
Prof. Dr. Hendrik Drachsler

**Mentor:** Daniele Di Mitri,  
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**Evaluation:** Design-driven evaluation



**Resources:**

- Website of the Hytea project [www.hytea.de](http://www.hytea.de)
- Previous version of the Presentation Trainer (Microsoft Kinect version)  
<https://edutec.science/presentation-trainer-2/>

## [2.3] Training oral presentation skills with motion capture



**Background.** There are different techniques that help people to read, understand, and remember the content of a text. One of these techniques consists of writing down the summary of a text's first paragraph in one sentence. Write in one sentence the summary of the second paragraph. For the next paragraphs, one needs to write two sentences, 1 summarising what happened previously, and one summarising the current paragraph. Current text readers are not designed for this practice.

**Research Task.** Develop a text reader designed for this practice. Explore to what extent LLMs can be used to assess if the user provided good summaries or not and help users to correct their summaries.

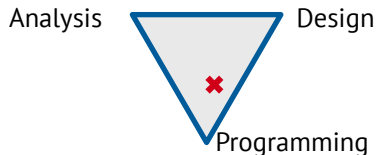
**Expected result.** An application that users can use to conduct an active reading approach that helps them to understand and remember the content of texts.

**Suitable for:** Bachelors & Masters

**First examiner (Betreuer):**  
Prof. Dr. Hendrik Drachsler

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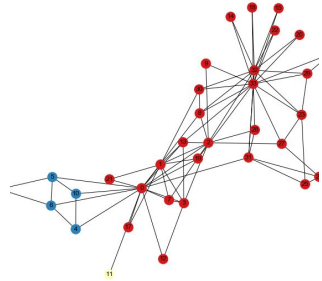
**Evaluation:** Design-driven evaluation







## [3.1] A network analysis of source texts

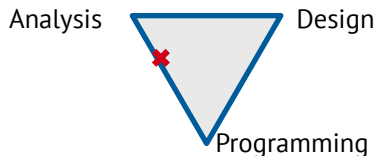


**Suitable for:** Bachelors & Masters

**First examiner (Betreuer):**  
Prof. Dr. Hendrik Drachsler

**Mentor:** Sebastian Gombert,  
<s.gombert@dipf.de>

**Evaluation:** Research-driven evaluation



**Background.** In the project CORE, we study learners' abilities to critically deal with online sources while solving critical online reasoning tasks. For this purpose, we collected an authentic dataset of learners' engaging with various online sources while solving a range of tasks. We logged all sources these learners used (websites, PDF downloads, ...). At the moment, the data is still in this raw state. To get a first glance of what pages were important, we want you to apply network analysis to this data.

**Research Task.** 1. Calculate a network of online sources. In this network, each node corresponds to an individual source. The edges between nodes indicate whether a source was used by the same learner with the weight being an integer counting how often this was the case. 2. What are the properties of texts that are very central? What are the properties of texts that are less central? Are there clusters of texts that are visible within the network? You can apply methods such as modularity clustering here to discover clusters. Or you can carry out a regression analysis to find out what predicts the importance of a node within the network. Is it just how high a source is ranked by Google, or is the quality or structure of the content also predictive? Can you relate any Psycholinguistic properties? There are multiple directions to go from here. As BA student, you would focus on one or two, while as MA student, you would explore a bunch.

**Expected Result.** An exploratory study which sheds light onto the factors which influence the importance of a source among our participants.