Using learning analytics to support dynamic learning paths in higher education

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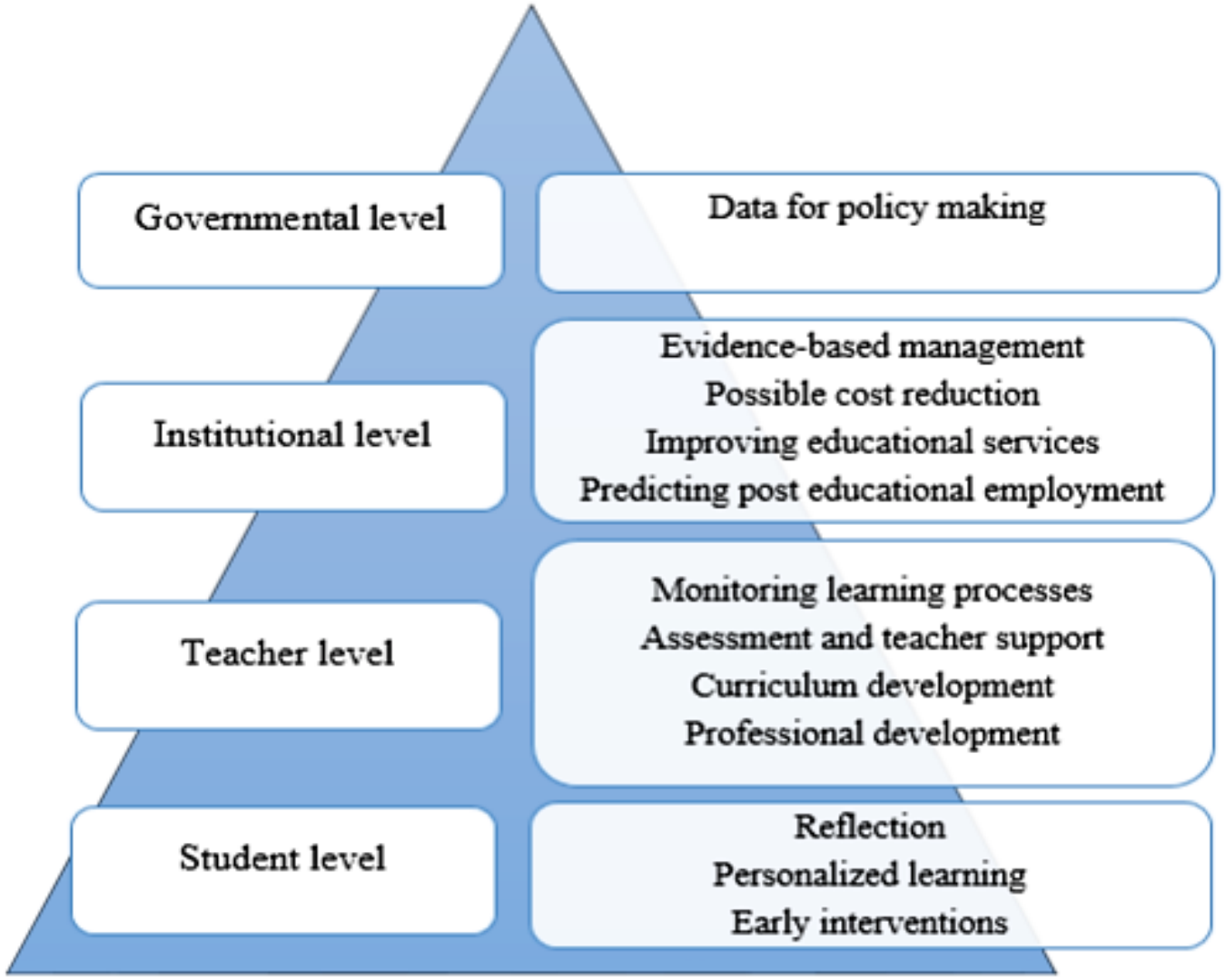
Learning analytics

Learning analytics is the collection, analysis, and reporting of data about learning. To optimize learning processes and environments in which the measurable learning occurs.

Digital traces of learning and teachers' activities can be collected and presented as feedback for users by visualized results.



Learning analytics use at different levels of educational system

(Gedrimiene, Silvola, Pursiainen, Rusanen & Muukkonen, submitted)

- Based on the collected data, different optimizations, interventions, adaptations, personalisations or predictive models and assessments can be done
- To support decision-making of different stakeholders

What type of data is usually gathered?

- Socioeconomic data
- Previous educational results
- Various tests results (personality, standardised)
- Various assessment results (entry, standardized, formative, summative)
- Student's responses (correct, incorrect, partially correct)
- Time spend before responding
- Hints requested
- Repetition of wrong answers
- Errors made
- Total time spent practicing
- Number of practicing sessions
- Number of clicks
- Submission of assignments (on time, late)
- Participation in discussion forums
- Course selection
- Course completion
- Various bodily reactions, sensor and biosensor data

Usually obtained from learning management systems (LMS) e.g. Moodle

Bienkowski, Feng & Means, 2012; Elouazizi, 2014; Tempelaar ym. 2015; You, 2016

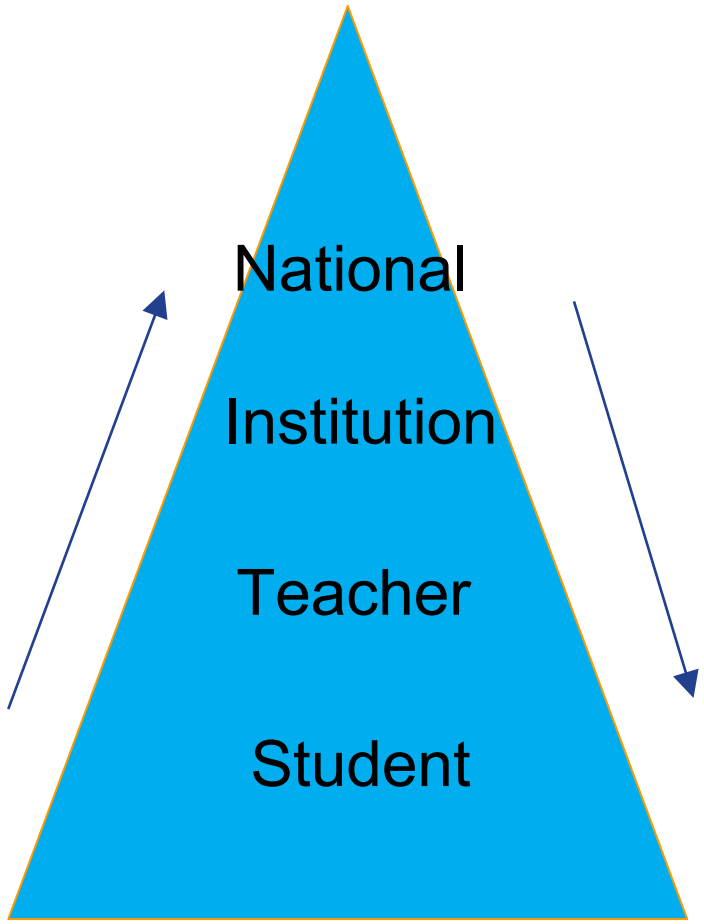
Ways to use learning analytics(1)

1. Student

- Planning of studies, personalised learning paths, recommendations in relation to goals and earlier achievements
- **Awareness of own activities and possibility for reflection based on feedback**
- Prediction: Based on activities and actions, students can receive anticipatory feedback about progress in course or studies- > interventions
- Support for self-regulation of learning and collaborative learning

2. Teacher / course

- Monitoring of students' learning processes
- Identify students with difficulties (task, methods, time use, learning difficulties, self-regulation, etc.)
- Early recognition of challenges in task or course completion, difficulties, drop-out risk -> pedagogical scaffolds and optimising
- Assessments of learning outcomes
- Teachers' professional learning, curriculum development



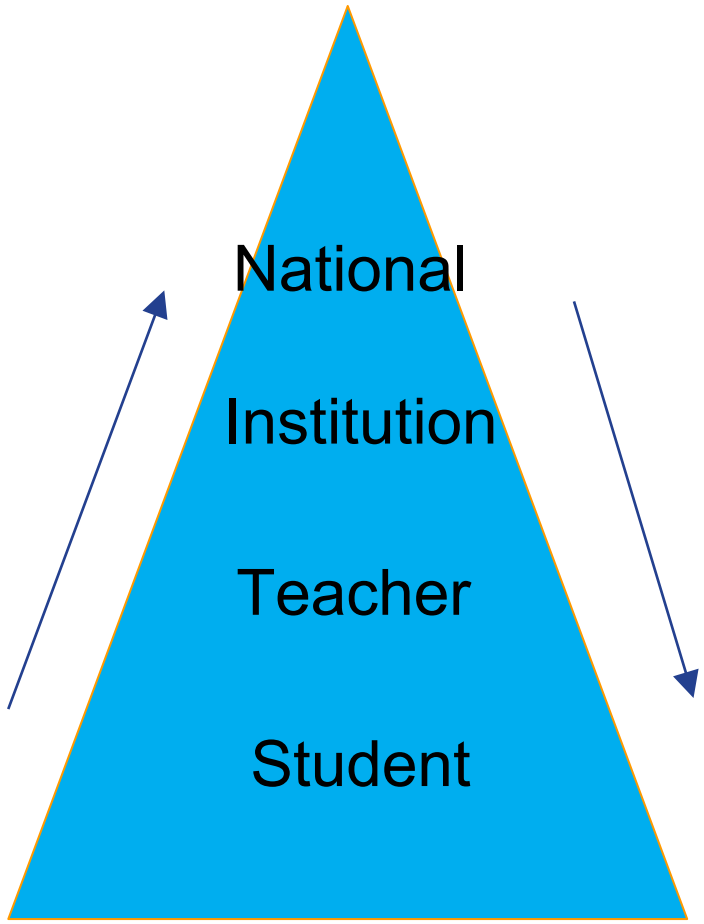
Ways to use learning analytics(2)

3. Institution

- Monitoring and evaluation of courses and programmes
- Long-term follow-up, planning and leadership of programmes
- Recognise problematic, tailorable or exceptional courses
- Possibility for improving cost-efficiency on long-term, initial investments add costs
- Development of institutional services, e.g. library use
- Data and research to support decision making
- Combined with post-graduation data, predictions for employability.

4. National / political

- Possibility to compare institution- or location-specific data
- Using register data to examine students' educational pathways
- Statistical knowledge for educational policy making
- Part of digital strategy



Boulden, 2015; Williamson, 2016; Yarnall, Means & Wetzel 2016; Hansen, Wasson 2016; Ozdemir & Stebbins 2015; Ognjanovic, Gasevic & Dawson 2016; Clow 2012; Avella, Kebritchi, Nunn & Kanai 2016; West, Heath & Huijser 2016

General trends

General trends in data analytics

- **Use in business ahead of educational use, but with different priorities**
- **Machine learning, AI, data crawling techniques**
- **GDPR, analytics national and institutional policy**
- **Coherent strategy for organizing, governing, analyzing and deploying organizations' information assets**
- **New data management functions e.g., chief data officer, data protection officer positions**
- **Primary purposes (Dallemule & Davenpost, 2017)**
  - Defense focuses on ensuring compliance with regulations (data governing, integrity of reporting, detecting fraud, preventing theft or data breaches)
  - Offence focuses on supporting objectives (increasing revenue, profitability, customer satisfaction, insights on processes, modelling, anticipation, facilitate managerial decision making)
  - Balancing data standardization and flexibility

Challenges and ethical concerns

The need for technology smart users and policy: Awareness of potential disadvantage for students or other users

Fragmented data from many different databases and data systems

Sclater (2014) highlights transparency, responsibility, clarity, respect of the users, the right to control the data about oneself and consent for the data use. An individual should have an opportunity to opt out from data collection and have an access for the data collected about him/her.

Data protection laws

Drachsler & Geller, 2016; Nistor et al. 2015; Pardo & Siemens 2014; Sclater 2014; Sclater & Bailey 2015; Siemens, 2013; Slade & Prinsloo 2013; Søby, 2013; Wasson, B. 2016; Picture from Sclater, 2014

Example cases

AnalyticsAI
Learning analytics supporting studying, instruction and leadership in universities

OULUN YLIOPISTO

TURUN YLIOPISTO

Aalto-yliopisto

LAPIN YLIOPISTO
UNIVERSITY OF LAPLAND

LUT University

Tampereen yliopisto

UNIVERSITY OF EASTERN FINLAND

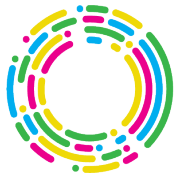
Opetus- ja kulttuuri-ministeriö

AnalytiikkaÄly
AnalyticsAI

Ministry of Education and Culture Finland funded project 2018-2020
https://analytiikkaaly.fi/in-english/

Project objectives

- Provide for students data on their study activities and utilize it in study planning and learning to learn
- Develop and pilot ways to use analytics data in student academic counselling
- Recognize and pilot ways to use analytics information in university leadership decision making
- Involve user groups in definition and evaluation of functionality and practices
- Employ information from registers, with attention to application interfaces, data protection and ethics

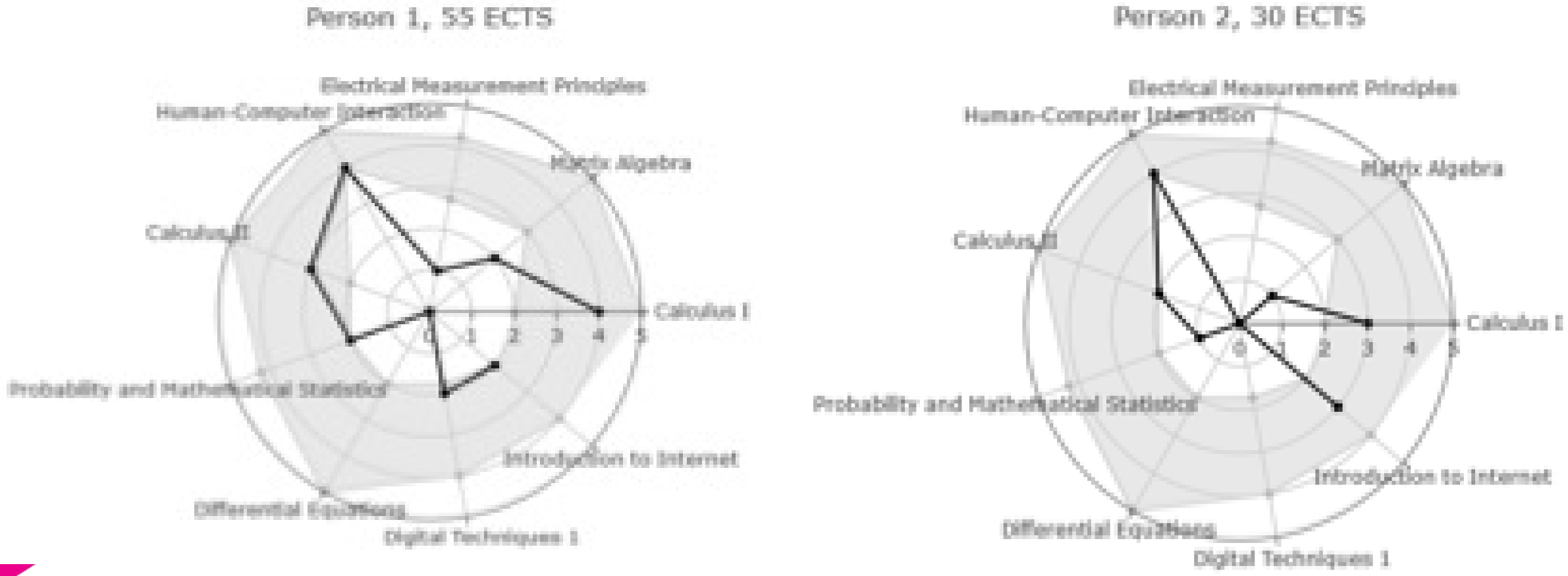


AnalytiikkaÄly
AnalyticsAI

AnalyticsAI: Examples of student (N = 155) expectations collected from workshops

	Challenges	Added value
Personally	1. Provides cold facts from one-sided perspective 2. Does not consider contextual or background factors 3. Poor visibility of cause-consequence links 4. No knowledge of how the given feedback affects the student	8. One tool for continuous monitoring and planning of learning 9. Getting feedback!! 10. Aids to recognise challenging aspects in studies 11. Gives student specific info on own competences, which provides opportunities for improvements
Generally	5. Suitability and interpretation of information 6. Transparency of data collection and ownership 7. Securing privacy	12. Ability to follow studies, development as learner 13. Better personalisation: personal solutions, tailored support, adjusted teaching 14. Development of teaching, teacher has possibility to monitor learning in progress, increased awareness

Figure 1. A radar plot of the first year's study records for two students in Engineering sciences. The performance of the student (black line) is compared to a middle 50% of the students with full 60 ECTS score (grey area).



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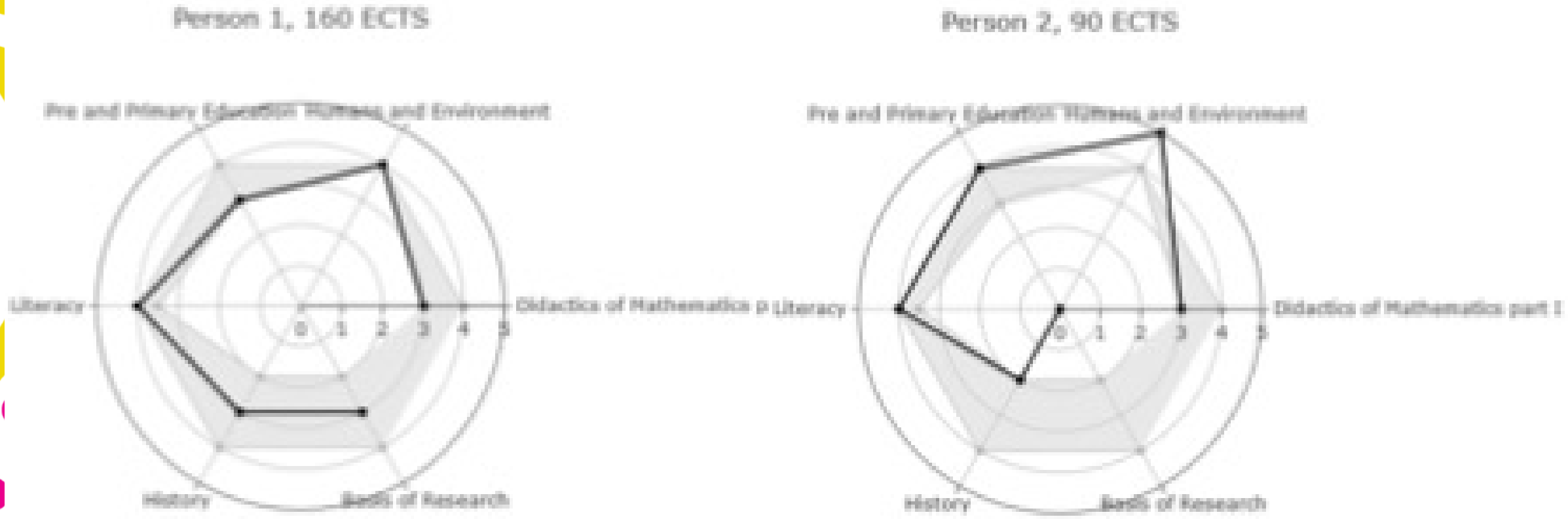
Muukkonen, Silvola, Tamminen, Varanka, Kokkonen, Hietaniemi, Pursiainen, Pirttikangas & Silvén (submitted)

Figure 2. A radar plot of the first year's study records for two students in Educational sciences. The performance of the student (black line) is compared to a middle 50% of the students with full 140 ECTS score (grey area).



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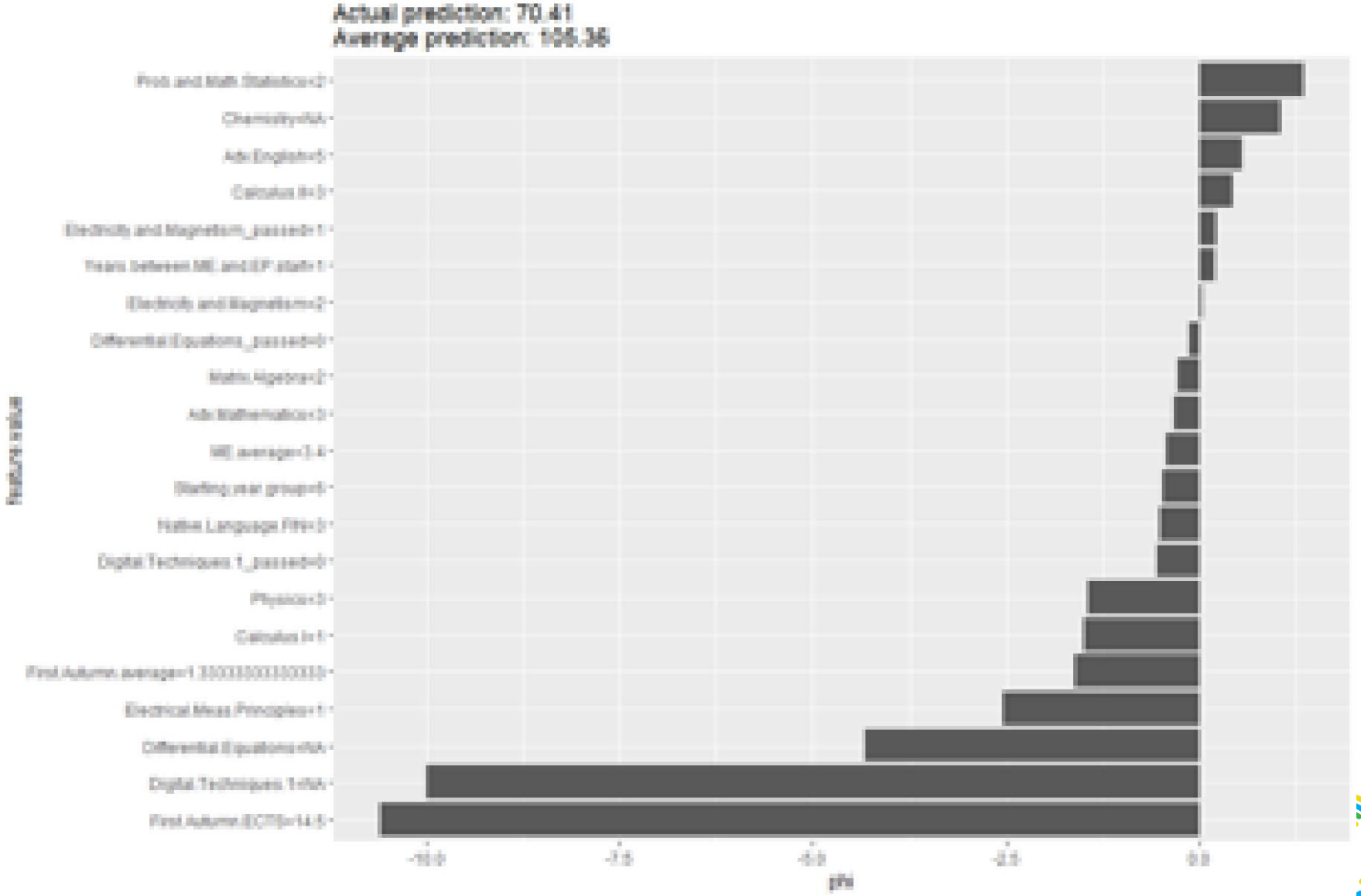
single technical student with low predicted cumulative ECTS score after 2



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Compleap

“A learner-centered digital ecosystem of competence development”

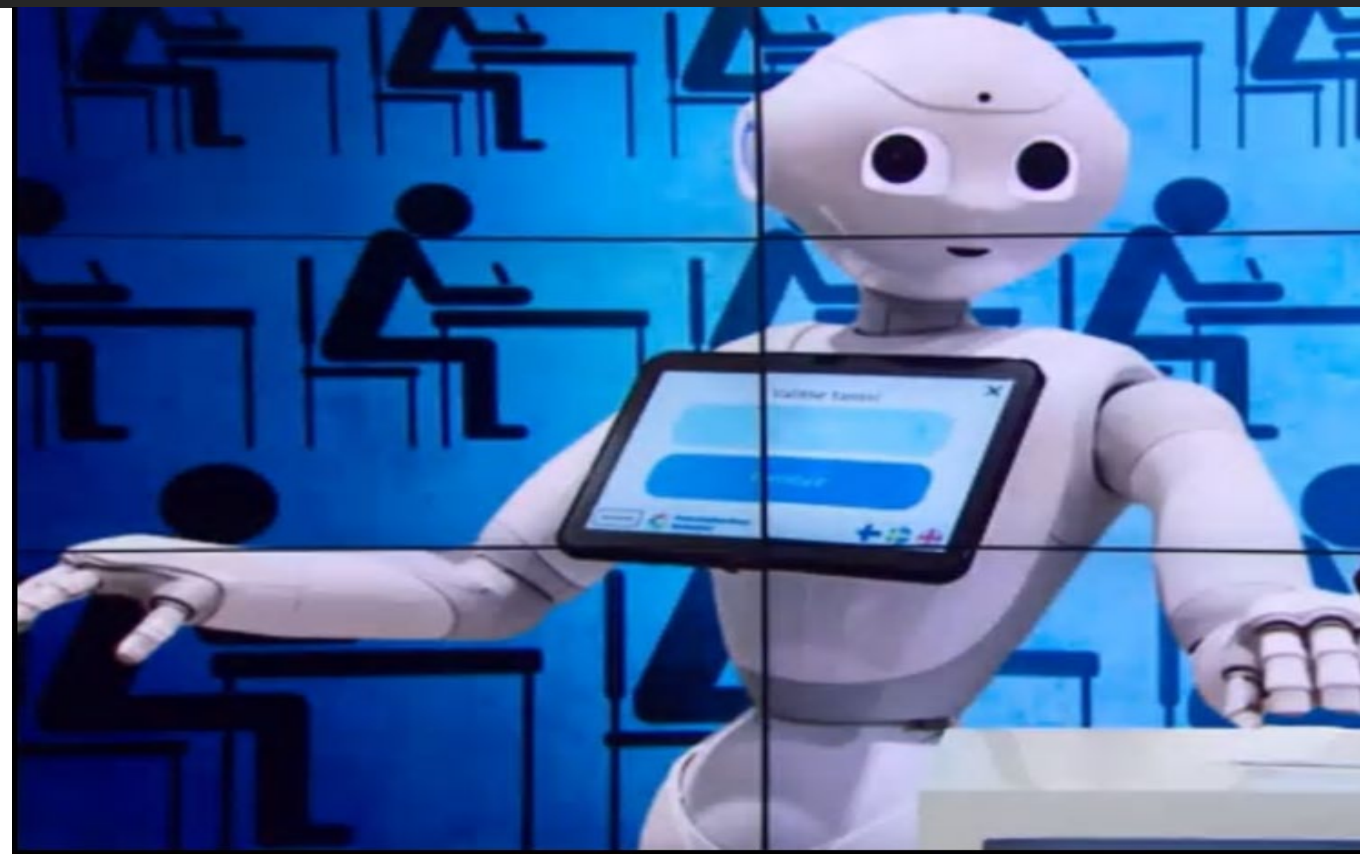
EU-project 12/2017-11/2019
https://www.compleap.eu

What kind of information is needed for planning a life-long learning trajectory?
What is my competence profile and what kind of additional education is available for me?
What kind of data would be valuable for an institution to develop their education and the portfolio?
What kind of personalized feedback and recommendation the users of digital services would prefer?

Background of the project

- Skills and competence mismatch
  - Changing labour market needs
    - Lack of certain skills
    - Overqualified
    - Immigration and refugees

- Changes in the working life
  - Digitalisation
  - Robotization
  - Automation



» Need to support **lifelong learning** of citizens in all ages throughout Europe

» How is re-skilling and up-skilling possible and supported?

» Digital services supporting lifelong learning?

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Compleap partners

FINNISH NATIONAL AGENCY FOR EDUCATION

UNIVERSITY OF OULU

Dienst Uitvoering Onderwijs
Ministerie van Onderwijs, Cultuur en Wetenschap

CSC

GRADIA

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A LEARNER-CENTRED APPROACH TO ARCHITECTURE DESIGN

Human-centred approach to personal data management and processing

Starting off from the learner's process

With the learner-centred MyData approach, the basic idea is that the individual him-/herself is controlling their own data instead of the organisation.

Aims to create a personalized experience

→ Offer visualisations of prior competences and education with suggestions about possible interesting study options

→ Based on register-based data, digital traces and user-produced information

→ To encourage users to think about own capabilities, interests and to compare various educational opportunities and study programs

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User groups

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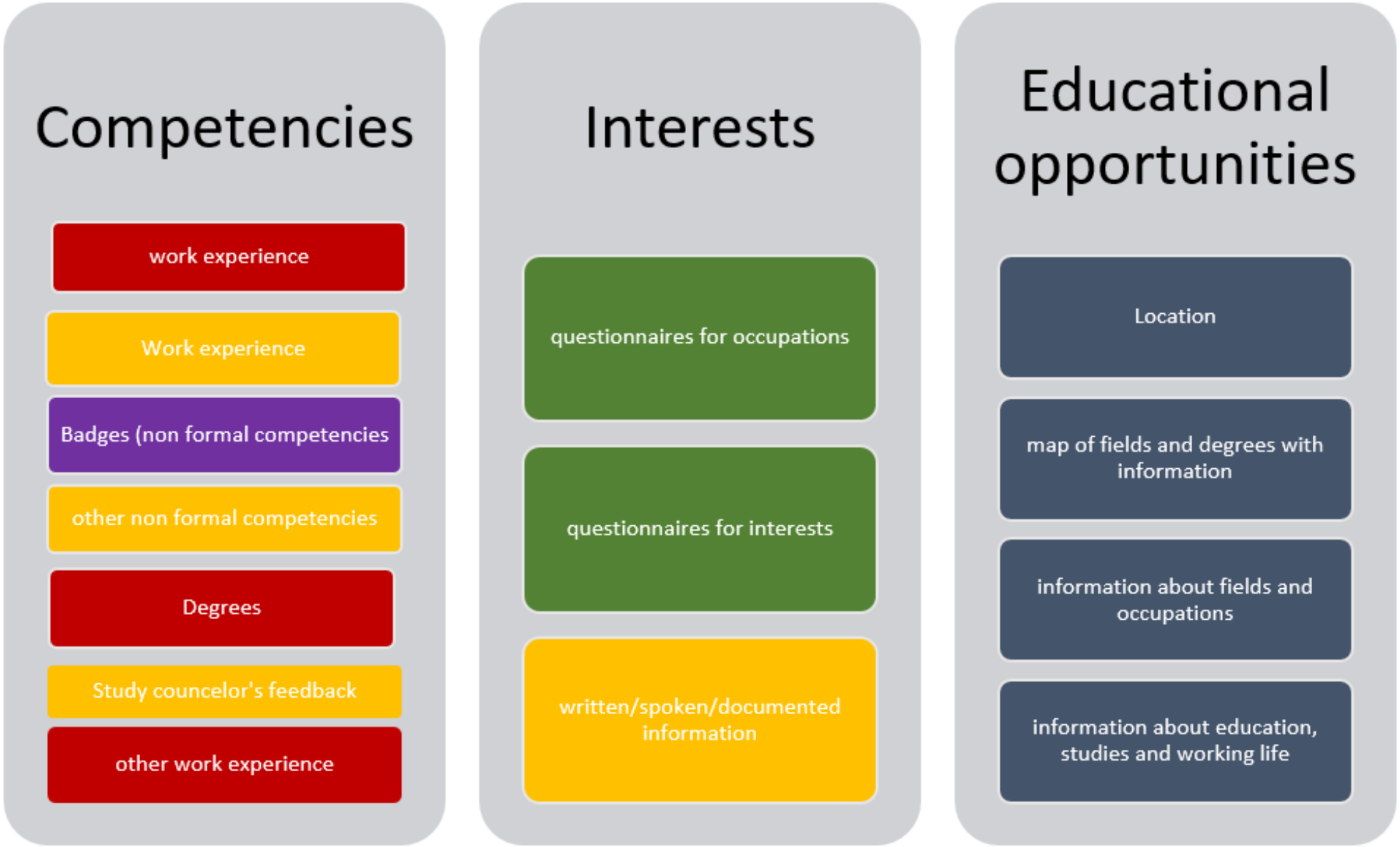
User group	Challenges	Special needs	Support needs
Immigrants	Missing data, languages skills, cultural differences	Simple language, multilingual, visualised and ease-of-use	strong
NEETs	Low motivation, learning difficulties, former negative experiences with education	Ease-of-use, compelling interface/use, gamification, ease of access to information, clarity and simple language	strong
Basic education graduates	Uncertain of their educational/vocational direction	Visualised and ease-of-use	medium
Unemployed	Circumstantial change, updating vocational competence	Relevance and validity of the data	medium
Shifting career	Circumstantial changes, looking for a new direction	Relevance and validity of the data	minimal



DATA SOURCES FOR PROTOTYPES

Red = data from registeries

Yellow = user generated data

Purple = structured data about non formal competencies

Green = interaction data/log data (user interaction with the content)

Blue = data of systems

WHAT IS OUR VISION

Supporting end-users in lifelong personal development

Prototype under development
https://poc.compleap.testiopintopolku.fi/

Competence and interest mapping → Suggested educational opportunities

Thank you!

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https://analytiikkaaly.fi
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