The Spanish Network of Learning Analytics: Achievements and Challenges

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SNOLA (Red Española de Analítica de Aprendizaje)

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Outline

• Introduction
• Achievements
  • SNOLA - A brief historical perspective
  • Current research trends in SNOLA
• Challenges
• Conclusions and open research lines
Introduction

- Networks or researchers and technology are at the core of any discipline (Latour, 2005)
- LA has grown “as it is” thanks to its networks

In Spain:

- There is interest in reflecting about the work done and contributions of the network, like in Papamitsiou, Giannakos, & Ochoa, (2020).

Goals and method

- **Goals:**
  - What has been the trajectory of the network?
  - What are the main research goals of its members?
  - What are the challenges in the field according to its members?

- **Method**
  - Review of archival data
  - Open ended questionnaire to the members of the network
  - Further elaboration with the respondents

Outline

• Introduction
• Achievements
  • SNOLA – Overview
  • Current research trends in SNOLA
• Challenges
• Conclusions and open research lines
SNOLA - History

- **2013**: Network kick-off
  - TEEM 2013
  - LASI 2013 (UC3M)

- **2014**: LASI 2014 (UNED)

- **2015**: 1st Official Recognition
  - TEEM 2015
  - LASI 2015 (U Deusto)

- **2016**: LASI 2016 (U Deusto)

- **2017**: LASI 2017 (UC3M)
  - EDUCON 2017

- **2018**: LASI 2018 (U León)

- **2019**: LASI 2019 (U Vigo)

- **2020**: 2nd Official Recognition
  - TEEM 2020
  - LASI 2020 (U Va, Online)

Network kick-off 2013
1st Official Recognition 2015
2nd Official Recognition 2020

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• Open to other groups and stakeholders at a local and international level
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• Challenges
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Current research trends

• Analysis of the open questionnaire
• Main results
  • Characterization of the network
  • Identification of 7 (non-orthogonal) research trends
• General characteristics
  • 34 distinct research lines
  • Goals (most cited):
    • Increase learner retention and performance (26)
    • Improve the quality of the learning environment (16)
    • Identify indicators for learning / elements of the learner model (7+4)
  • 7 research trends
### Research Trends

**Predictive learning analytics**

<table>
<thead>
<tr>
<th>Research line</th>
<th>Publication</th>
<th>User(s)</th>
<th>Data sources</th>
<th>Analysis techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prediction of learning results and dropout</td>
<td>(Moreno-Marcos et al., 2020)</td>
<td>S / T / M</td>
<td>Students’ actions (MOOC)</td>
<td>Random Forest, Regression, Neural Networks, Decision Trees</td>
</tr>
<tr>
<td>Identification of engineering students at risk</td>
<td>(Martínez et al. 2019)</td>
<td>S / T</td>
<td>Students actions (Moodle and Virtual Campus)</td>
<td>Predictive analysis</td>
</tr>
<tr>
<td>Prediction of learning results and dropout</td>
<td>(Cobos &amp; Olmos, 2018)</td>
<td>T / M</td>
<td>Students actions (MOOCs)</td>
<td>Predictive analytics, Machine Learning, Statistical analysis</td>
</tr>
<tr>
<td>Actionable information based on prediction of academic engagement in MOOCs</td>
<td>(Bote-Lorenzo &amp; Gómez-Sánchez, 2018)</td>
<td>S / T</td>
<td>Students’ actions (MOOC)</td>
<td>Feature selection, Machine Learning</td>
</tr>
<tr>
<td>Analysis and classification of student data with prediction purposes (Interactions)</td>
<td>(Agudo-Peregrina et al., 2014)</td>
<td>T / M / R</td>
<td>Student’s actions (Moodle)</td>
<td>Log data classification, Regression</td>
</tr>
<tr>
<td>Educational data mining</td>
<td>(Guerrero-Higueras et al., 2019)</td>
<td>S / T</td>
<td>Students actions (Version system)</td>
<td>Machine Learning</td>
</tr>
<tr>
<td>Definition of high-level actionable indicators based on low level data.</td>
<td>(Alexandron et al., 2017)</td>
<td>S / T</td>
<td>Students’ actions (MOOC)</td>
<td>Machine Learning, Artificial Intelligence Techniques, Semantic modelling, Heuristics</td>
</tr>
</tbody>
</table>
DROPOUT PREDICTION

- Self-paced MOOCs: Model depend on enrollment date
- Event-based SRL variables are useful to predict dropout
- Good predictions from 25-33% of the theoretical MOOC duration

DATA USE to PREDICT

- Videos ✓
- Exercises ✓
- Activity ✓
- Self-regulated learning (SRL)
  - Self-reported SRL ✗
  - Event-based SRL ✓
- Demographics and intentions ✗

Research Trends

Predictive learning analytics

• Identification of engineering students at risk

## Research Trends
### Visual analytics

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<tr>
<td>Visual analytics of eLearning systems (VeLA)</td>
<td>(Gómez-Aguilar et al., 2014)</td>
<td>T</td>
<td>Students’ actions on the VLE, Grades</td>
<td>Visual analytics</td>
</tr>
<tr>
<td>LA Dashboards for virtual labs</td>
<td>(Tobarra et al., 2014)</td>
<td>S</td>
<td>Platforms logs</td>
<td>Heuristics</td>
</tr>
<tr>
<td>Visual Analytics of students’ actions</td>
<td>(Ruipérez-Valiente, et al., 2015)</td>
<td>S / T</td>
<td>Students’ actions on the system (MOOC)</td>
<td>Visual analytics</td>
</tr>
<tr>
<td>LA Dashboard for MOOCs</td>
<td>(Cobos et al., 2016)</td>
<td>T / M</td>
<td>Students’ actions on the system (MOOC), grades, demographics, self-reported data</td>
<td>Descriptive Statistics</td>
</tr>
<tr>
<td>Visualization of peer and self-assessment data in Moodle (MWDEX)</td>
<td>(Chaparro-Peláez, et al., 2019)</td>
<td>T</td>
<td>Peer-assessment grades (Moodle Workshops)</td>
<td>Visual Analytics</td>
</tr>
<tr>
<td>Automatic generation of adapted dashboards</td>
<td>(Vázquez-Ingelmo et al., 2019)</td>
<td>S / T / M / R</td>
<td>-</td>
<td>Multi-Dimensional Analysis (MDA), ML</td>
</tr>
<tr>
<td>Graph generation of educational data in online learning for social network analytics (GraphFES)</td>
<td>(Hernández-García &amp; Suárez-Navas, 2017)</td>
<td>T / M</td>
<td>Student activity (Moodle log data-Forums)</td>
<td>Social Network Analysis, Data visualization</td>
</tr>
</tbody>
</table>
Research Trends
Visual analytics

- Dashboard for virtual evaluation laboratories

Research Trends

Visual analytics

- Visualization of peer and self-assessment data in Moodle – Moodle Workshop Data EXtractor (MWDEX)

• Automatic generation of adapted dashboards

# Research Trends

## Support to active learning strategies

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<tr>
<td>Adaptive learning based on user models</td>
<td>(Muñoz-Merino et al., 2018)</td>
<td>S / T</td>
<td>Students’ actions on the system (Intelligent Tutoring Systems)</td>
<td>Bayesian networks, rules, Item Response Theory.</td>
</tr>
<tr>
<td>Support to dialogic peer feedback (Synergy)</td>
<td>(Er et al., 2019)</td>
<td>S / T</td>
<td>Students actions on the system, content of the feedback,</td>
<td>Descriptive statistics</td>
</tr>
<tr>
<td>Social learning supported by learning analytics</td>
<td>(Claros et al., 2015)</td>
<td>S / T</td>
<td>Students actions on the system (content and social)</td>
<td>SNA, CSCL</td>
</tr>
<tr>
<td>Learning analytics to improve Flipped Classrooms</td>
<td>(Rubio-Fernández et al., 2019)</td>
<td>S / T</td>
<td>Students’ actions on the system (SPOC)</td>
<td>Visual analytics, clustering, adaptation</td>
</tr>
<tr>
<td>Definition of design criteria for self-regulated learning support tools</td>
<td>(Manso-Vázquez, et al., 2018)</td>
<td>M</td>
<td>xAPI profile</td>
<td>-</td>
</tr>
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</table>
Support to active learning strategies

• Supporting the scalability of collaborative peer feedback
  • Based on a model of dialogic peer feedback
  • Instructor dashboards for class-wide interventions
  • Student dashboards for supporting:
    • Self-regulation, co-regulation, and socially shared regulation of learning.
• LA-empowered online platform:
  • Synergy, synergylearn.net

# Research Trends

## Learning analytics for Learning Design

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<tr>
<td>Support to learning design processes (ILDE2)</td>
<td>(Michos, Hernández-Leo, &amp; Albó, 2018)</td>
<td>T</td>
<td>Actions on ILDE2, (a kind of social network for teachers), feedback on teachers’ and students</td>
<td>Social Network Analysis (SNA), data visualization, descriptive statistics</td>
</tr>
<tr>
<td>Learning analytics for learning design (OrLA, T-Glade, TAP)</td>
<td>(Wiley, Dimitriadis, Bradford, &amp; Linn, 2020)</td>
<td>T / R</td>
<td>Students actions on the system (WISE science inquiry system); submission of results; grades</td>
<td>TAP (an NLP method)</td>
</tr>
</tbody>
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Research Trends
LA for Learning Design

• How can teachers investigate the impact of learning activities in their context (e.g. schools)?

• An approach that connects LA with analytics of learning designs across multiple educators in a community

• Technology supporting teachers:
  • Design of learning activities
  • Formulation of inquiries
  • Collecting, aggregating visualizing data
  • Community sharing, community inquiry

## Research Trends

### Assessment support

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<tr>
<td>Definition and adjustment of assessment processes (Ramon / TEA)</td>
<td>(Villamañe et al., 2017)</td>
<td>S / T / ID</td>
<td>Students’ answers, grades</td>
<td>Statistics, Regression, NNLS, Data visualization</td>
</tr>
<tr>
<td>Learning analytics for the assessment of 21st-century skills</td>
<td>(Menchaca et al., 2018)</td>
<td>S / T</td>
<td>Grades</td>
<td>Heuristics</td>
</tr>
<tr>
<td>Analysis of Moodle logs for decision making and workgroup assessment</td>
<td>(Tobarra et al., 2017)</td>
<td>S / T</td>
<td>MOOC platform logs</td>
<td>Heuristic</td>
</tr>
<tr>
<td>Workgroup assessment</td>
<td>(Conde et al., 2018)</td>
<td>S / T</td>
<td>Students’ actions on the system (VLE)</td>
<td>Quantitative analysis and heuristics</td>
</tr>
<tr>
<td>Measurement and analysis of teamwork indicators in online education (TeamworkRM)</td>
<td>(Hernández-García et al., 2018)</td>
<td>T</td>
<td>Students’ actions (Moodle log data-Forums &amp; wikis)</td>
<td>Data classification (ETL), Regression</td>
</tr>
</tbody>
</table>
Research Trends
Assessment support

• Assessment of 21st century skills
  • Integrate formative student assessment data from different tools
  • Criteria for data analysis based on assessment rubrics.

Assessment support

• Assessment of teamwork to populate a competence ontology

## Research Trends

### Multimodal and contextual data

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<tr>
<td>Students monitoring in blended learning environments (CASA, AdESMuS)</td>
<td>(Villamañe et al., 2020)</td>
<td>S / T</td>
<td>Grades</td>
<td>Statistics, Linear Regression, Data visualization</td>
</tr>
<tr>
<td>Multimodal learning analytics of f2f collaborative learning</td>
<td>(Vujovic &amp; Hernández-Leo, 2019)</td>
<td>T / R</td>
<td>Multimodal data, motion capture, EDA, sound, students’ self-reported data</td>
<td>ML, statistic analysis</td>
</tr>
<tr>
<td>Use of wearables to estimate levels of stress and sleep quality.</td>
<td>(de Arriba-Pérez et al., 2018)</td>
<td>S</td>
<td>Biometric signals</td>
<td>ML</td>
</tr>
<tr>
<td>Design-aware learning analytics (GLUE!-CASS, Glimpse)</td>
<td>(Rodríguez-Triana et al. 2015)</td>
<td>T</td>
<td>Students actions on the system (DLE), data from the learning design, self-reported data</td>
<td>Heuristics</td>
</tr>
</tbody>
</table>
Multimodal and contextual data

• Helping teachers to
  • Define the multiple assessment approaches in a course
  • Integrate and analyze the collected data

Research Trends
Multimodal and contextual data

• Do sensors in wearables provide adequate data to estimate stress and sleep quality?

de Arriba-Pérez, F., Caeiro-Rodríguez, M., & Santos-Gago, J. M. (2018). How do you sleep? Using off the shelf wrist wearables to estimate sleep quality, sleepiness level, chronotype and sleep regularity indicators. *Journal of Ambient Intelligence and Humanized Computing, 9*(4), 897–917. [https://doi.org/10.1007/s12652-017-0477-5](https://doi.org/10.1007/s12652-017-0477-5)
# Research Trends

## Sentiment analysis

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<tr>
<td>Social and sentiment analysis</td>
<td>(Ros et al., 2017)</td>
<td>S / T</td>
<td>Forum messages</td>
<td>Heuristics</td>
</tr>
<tr>
<td>Academic success prediction based on emotion modelling (PresenceClick)</td>
<td>(Ruiz et al., 2018)</td>
<td>S / T</td>
<td>Sensors, self-reported emotions</td>
<td>Transition matrix, Decision trees, Data visualization</td>
</tr>
<tr>
<td>Sentiment Analysis</td>
<td>(Cobos et al., 2019)</td>
<td>T / M</td>
<td>Student. actions on the system (MOOCs), MOOC contents</td>
<td>Descriptive analytics, Natural Language Processing (NLP), Sentiment Analysis</td>
</tr>
</tbody>
</table>
Research Trends

Sentiment analysis

edX-CAS
A Content Analysis System that supports Sentiment Analysis for Subjectivity and Polarity detection in Online Courses at edX

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Challenges

• Increase adoption by end users (8)
• Ethical, privacy, and security issues (7)
• Quality of process and the results (6)
• Increase personalization / adaptation / interoperability of data and tools (5)
• Improve real learning (5)
• Apply LA at an institutional level (5)
Conclusions & Open research lines

• SNOLA has maintained sustained levels of activity and boosted research in LA in the Spanish context

• This work provides a first overview of the activity of SNOLA, its research trends and interests

• New research lines are open
  • Contribute to international reflection on current trends and challenges in LA
  • Identification of gaps and challenges to drive future action
Thanks on behalf of all the SNOLA team!