

Paper Summary

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Title: YarnSense: Automated Data Storytelling for Multimodal Learning Analytics

Authors: Gloria Milena Fernández-Nieto, Vanessa Echeverria, Roberto Martinez-Maldonado, Simon Buck

DOI: N/A

Year: 2024

Publication Type: Conference (Workshop Proceedings)

Discipline/Domain: Learning Analytics / Educational Technology

Subdomain/Topic: Automated Data Storytelling, Multimodal Learning Analytics, Nursing Simulation Training

Eligibility: Eligible

Overall Relevance Score: 88

Operationalization Score: 90

Contains Definition of Actionability: Yes (implicit)

Contains Systematic Features/Dimensions: Yes

Contains Explainability: Yes

Contains Interpretability: Yes

Contains Framework/Model: Yes

Operationalization Present: Yes

Primary Methodology: Conceptual + Reference Implementation

Study Context: Clinical nursing simulation with 254 students, 6 teachers

Geographic/Institutional Context: Monash University (Australia), University of Technology Sydney, Escuela

Target Users/Stakeholders: Students, Teachers, Researchers in education/training

Primary Contribution Type: Architecture & System Implementation

CL: Yes

CR: Yes

FE: Yes

TI: Yes

EX: Yes

GA: Yes

Reason if Not Eligible: N/A

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YarnSense: Automated Data Storytelling for Multimodal Learning Analytics

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****Discipline/Domain:****

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****Subdomain/Topic:****

Automated Data Storytelling, Multimodal Learning Analytics, Nursing Simulation Training

****Contextual Background:****

The paper addresses the challenge of making complex multimodal learning analytics data interpretable a

****Geographic/Institutional Context:****

Monash University (Australia), University of Technology Sydney (Australia), Escuela Superior Politecnica

****Target Users/Stakeholders:****

Students, Teachers, Educational Researchers

****Primary Methodology:****

Conceptual architecture development with in-the-wild reference implementation

****Primary Contribution Type:****

System architecture + case study

General Summary of the Paper

The authors present **YarnSense**, a multi-tier architecture for automatically generating educational data s

Eligibility

Eligible for inclusion: ****Yes****

How Actionability is Understood

Actionability is framed implicitly as the ability of multimodal data outputs to ****support reflection, identify pe**

> “Based on the notion of data storytelling as a means of extracting actionable insights from data...” (Abs

> “...weaving complex data into coherent narratives that align with the teacher’s pedagogical intentions” (

What Makes Something Actionable

- Alignment with teacher’s pedagogical intentions and learning design
- Translation of raw sensor data into meaningful constructs
- Integration of contextual knowledge (roles, resources, assessment criteria)
- Clear visual and narrative presentation to non-experts
- Timely delivery to support post-activity reflection
- Inclusion of error detection and performance feedback linked to guidelines

How Actionability is Achieved / Operationalized

- **Framework/Approach Name(s):** YarnSense Architecture
- **Methods/Levers:** Pedagogical rule definition, sensor-based multimodal data capture, QE modelling,
- **Operational Steps / Workflow:**
 1. Teachers define learning context & pedagogical intentions (Context Modeller)
 2. Collect multimodal data from machine and human sensing
 3. Transform into learner models via multimodal matrices and QE modelling
 4. Generate DS outputs combining data, visuals, and teacher feedback
- **Data & Measures:** Positioning data, physiological data, audio/video, logged actions
- **Implementation Context:** Nursing simulations with defined critical actions and teamwork assessment

> “Data from the Learner Model are visualised and combined with narratives to convey a story for an indiv

Dimensions and Attributes of Actionability (Authors’ Perspective)

- **CL (Clarity):** Yes — DS principles include removing unnecessary elements, highlighting important fe
- **CR (Contextual Relevance):** Yes — tied to pedagogical intentions and activity specifics
- **FE (Feasibility):** Yes — aligned with realistic instructional and technological constraints
- **TI (Timeliness):** Yes — aimed at post-activity debriefs in near-real time
- **EX (Explainability):** Yes — multimodal constructs and DS enhance interpretability
- **GA (Goal Alignment):** Yes — narratives tied directly to teacher’s learning goals
- **Other Dimensions Named by Authors:** User agency in modifying rules; integration with teacher feedb

Theoretical or Conceptual Foundations

- Data Storytelling principles (purposeful communication, meaningful visuals, narrative structures)
- Quantitative Ethnography (QE)
- Multimodal Matrix methodology
- Theory of Proxemics for spatial interaction analysis

Indicators or Metrics for Actionability

- Error detection types (Sequence, Timeliness, Frequency)
- Time spent in proximity to patients or team members
- Adherence to clinical guideline-timed actions

Barriers and Enablers to Actionability

- **Barriers:** Complexity of multimodal data; automation challenges for certain modalities; need for context
- **Enablers:** Teacher-defined rules; automated DS generation; integration of multiple sensing modalities

Relation to Existing Literature

Builds on prior work in multimodal learning analytics and DS, extending from high-fidelity prototypes to full-scale implementation

Summary

YarnSense operationalises actionability in educational analytics as the transformation of raw multimodal data into actionable insights

Scores

- **Overall Relevance Score:** 88 — Strong conceptualisation of actionability through DS and pedagogical integration
- **Operationalization Score:** 90 — Comprehensive architecture, clearly defined workflow, demonstrated impact

Supporting Quotes from the Paper

- “[...] based on the notion of data storytelling as a means of extracting actionable insights from data...” (A)
- “... weaving complex data into coherent narratives that align with the teacher’s pedagogical intentions” (A)
- “Data from the Learner Model are visualised and combined with narratives to convey a story for an individual learner” (A)

Actionability References to Other Papers

- Martinez-Maldonado et al. (2020) — Layered storytelling approach for multimodal learning analytics

- Echeverria et al. (2018) — Educational data storytelling for teacher attention
- Fernández-Nieto et al. (2022) — Combining visualisation, narrative, and storytelling for student data ins