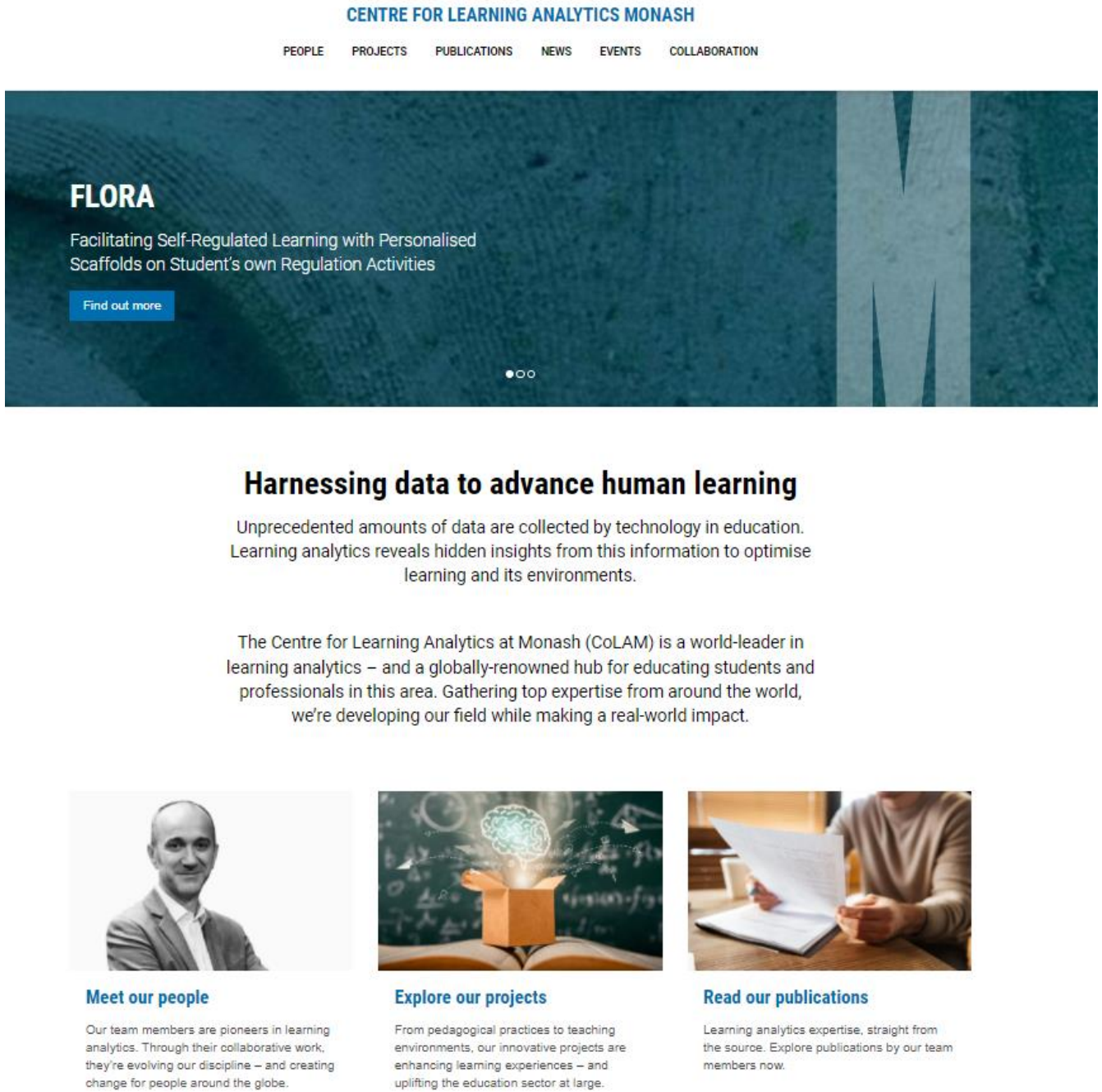
MONASH University

CLAM
Centre for Learning Analytics Monash

Transforming pedagogical practice with learning analytics

Dragan Gašević
@dgasevic

16th Jan, 2023
CPCECPR Conference 2023
PolyU Hong Kong



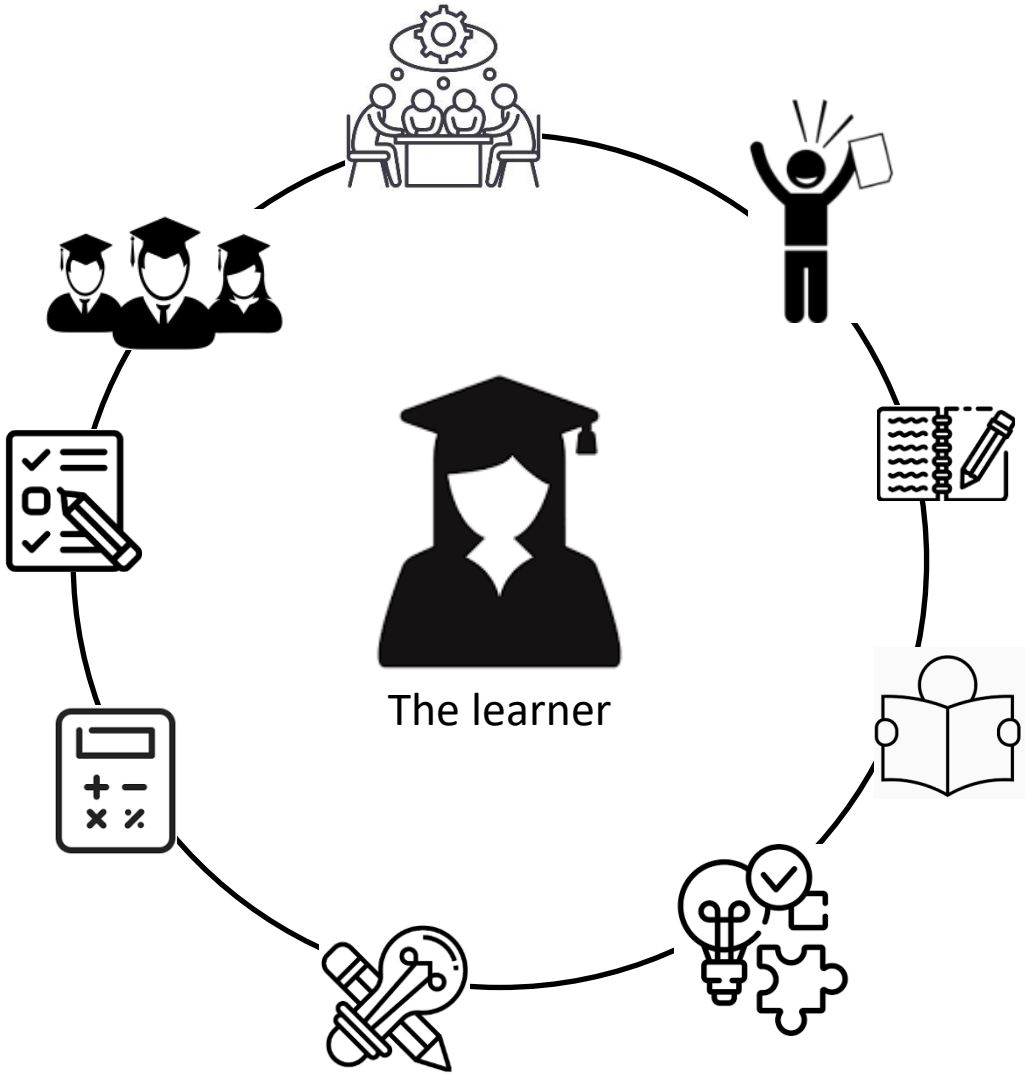
Quick facts

- Largest learning analytics institute in the world
- Over 70 members and affiliates
- Analytics in schools, higher ed, and workplace
- Over 100 partners from all over

https://www.monash.edu/colam

How to mange ever-growing complexity in pedagogical practice?

Context and need for analytics

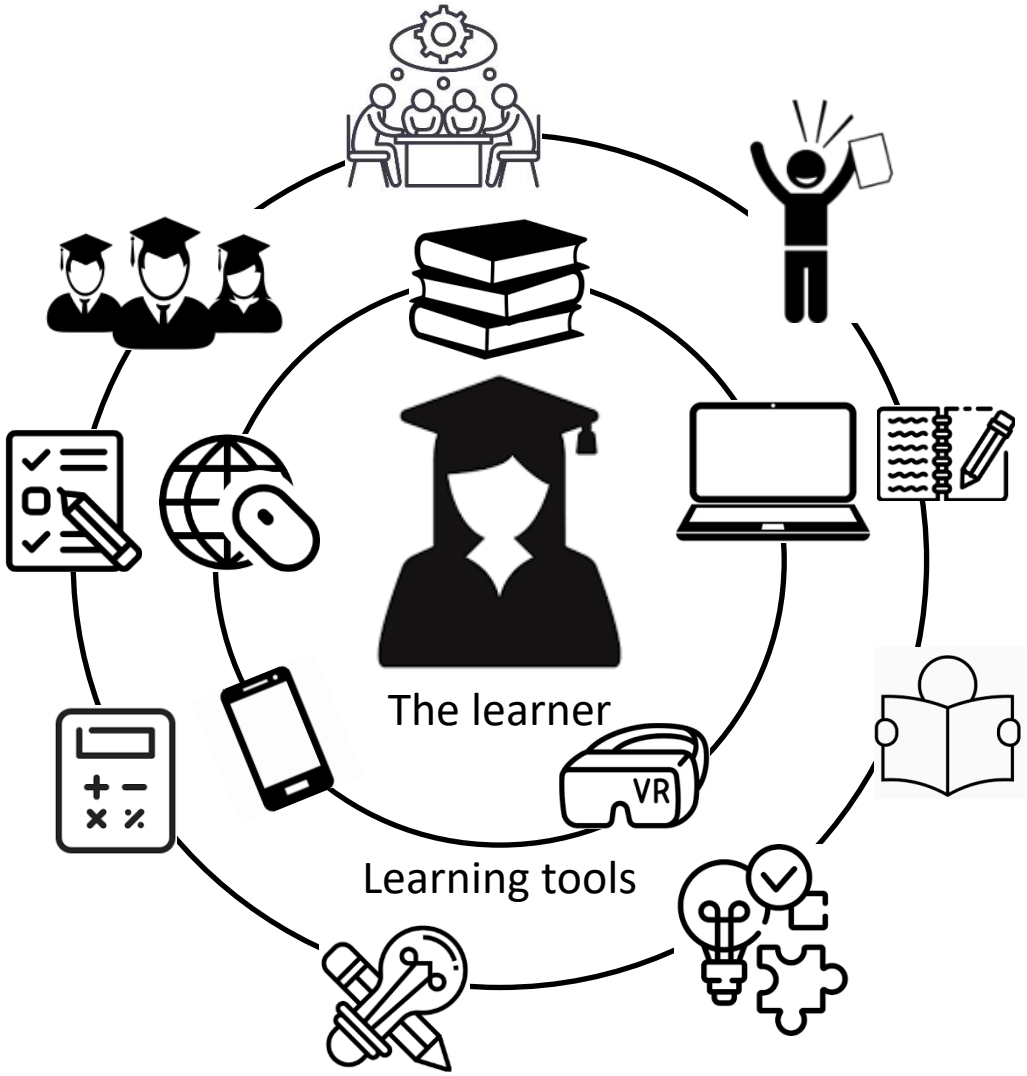


The learner

Learning activities

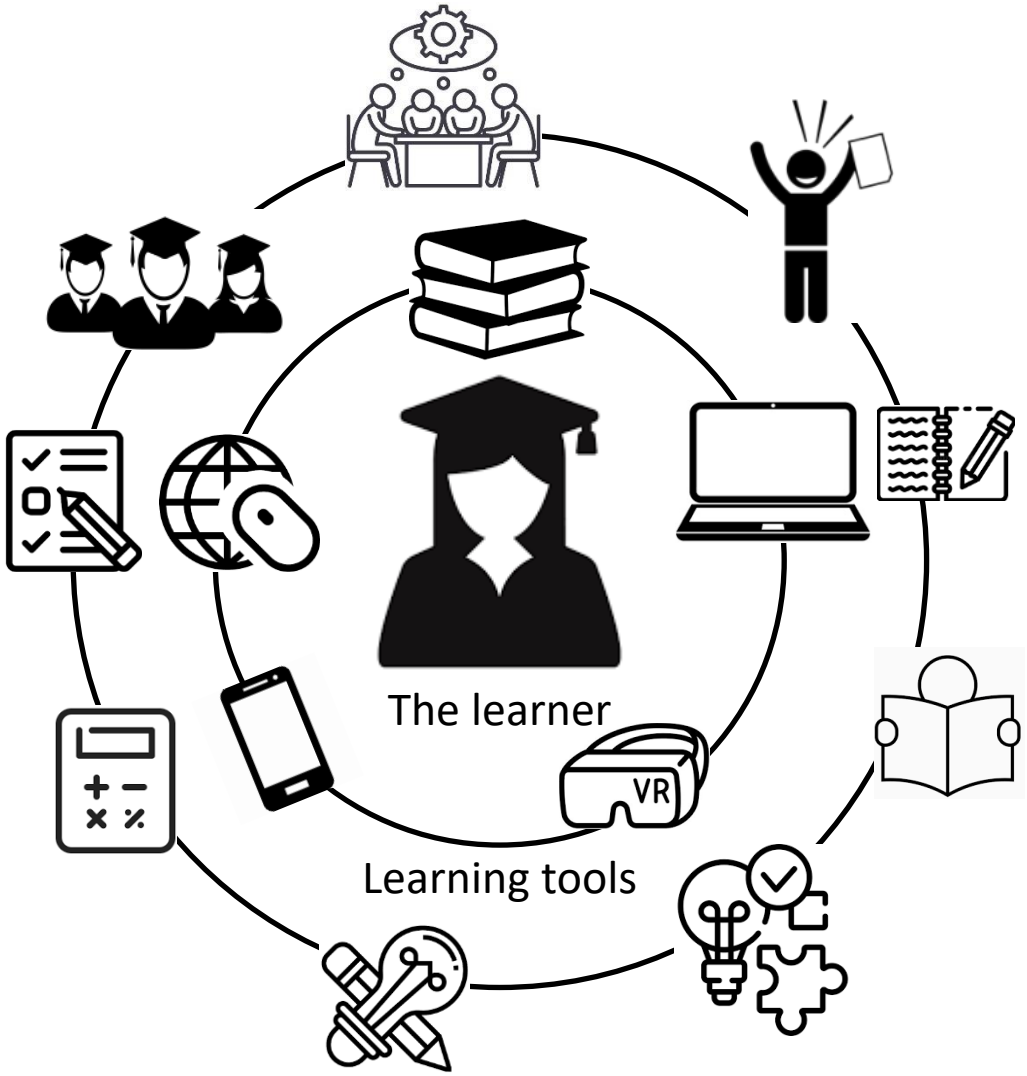
The educator

Context and need for analytics



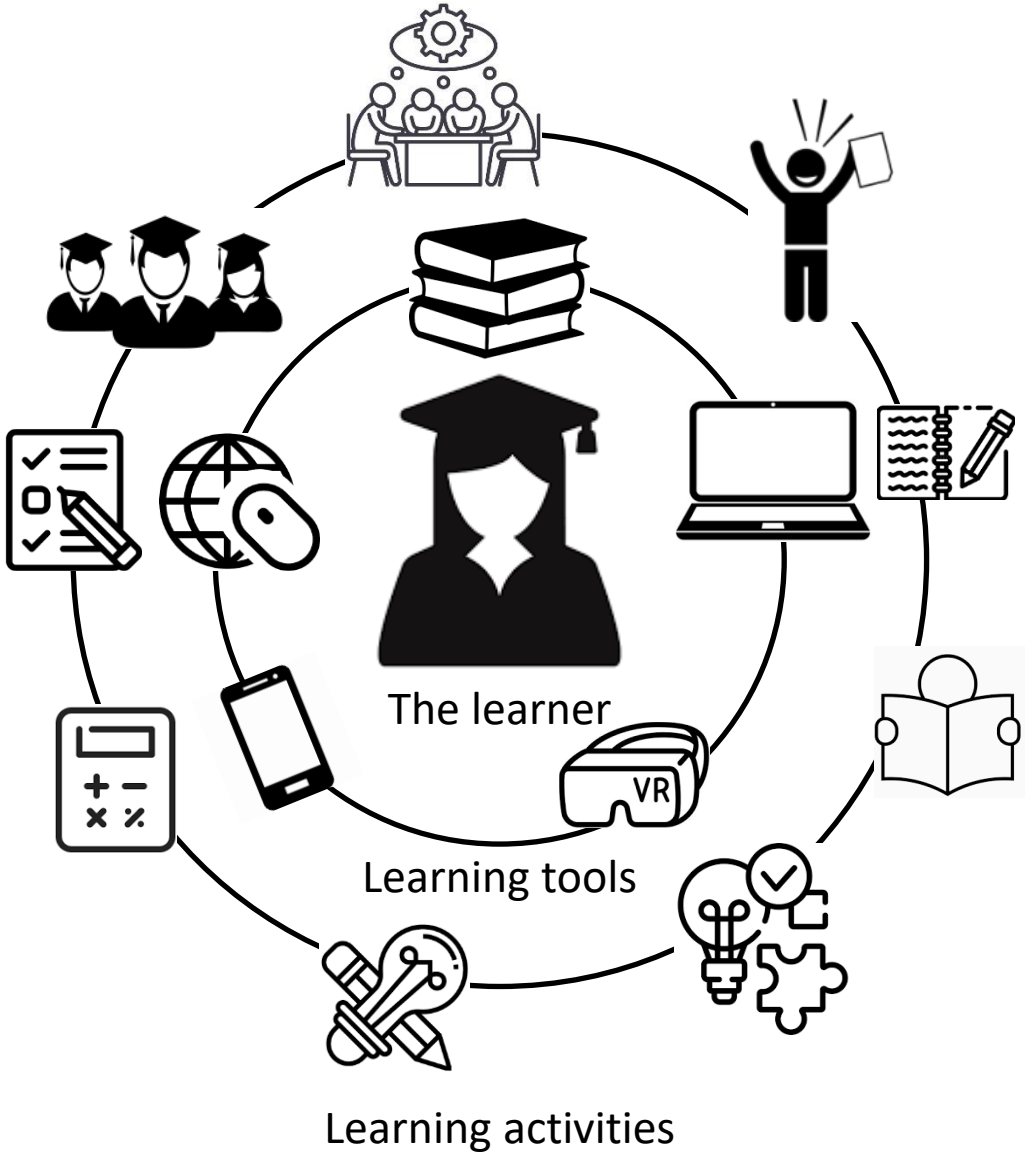
The educator

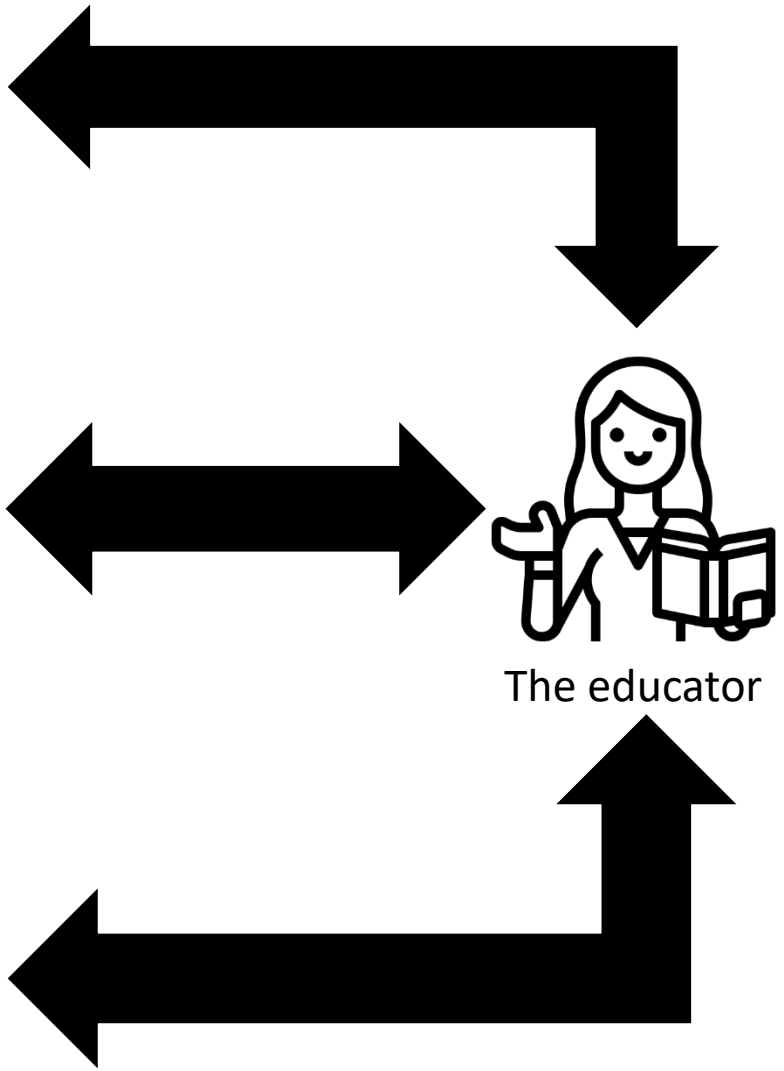
Context and need for analytics



The educator

Context and need for analytics





Learning Analytics

Much promise and high interest

Challenge

How do we transform pedagogical practice with learning analytics?

Key takeaway

Data collection and use should be preconceived, not an afterthought

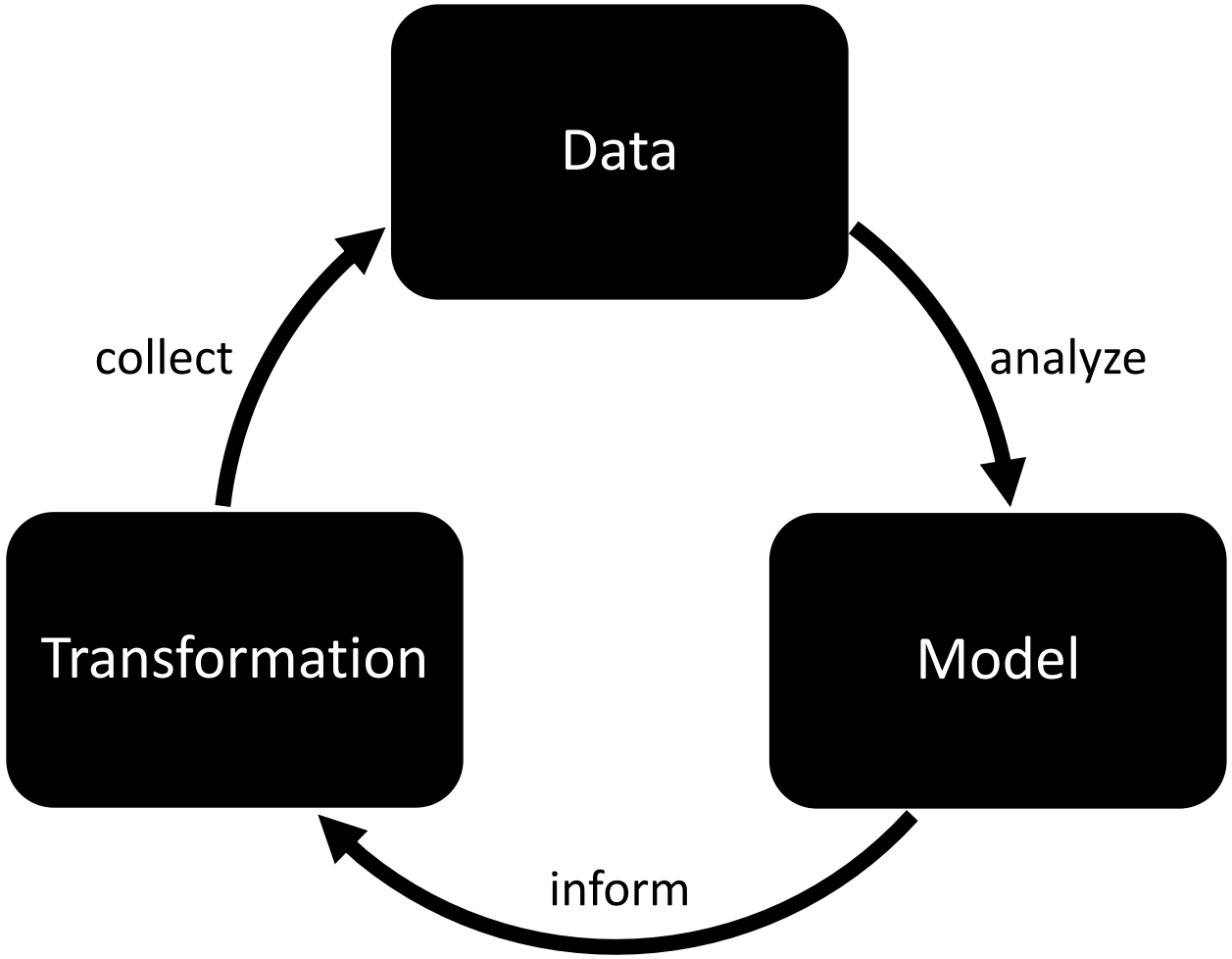
Key takeaway

Responsible design and use are key pillars, not catch phrases

Key takeaway

Consideration of complexity needs to inform transformation of practice

Closing the loop



Gašević, D., Tsai, Y-S., Dawson, S., & Pardo, A. (2019). How do we start? An approach to learning analytics adoption in higher education. *International Journal of Information and Learning Technology, 36*(4), 342-353.

DATA – MODEL – TRANSFORMATION – FINAL REMARKS

Data are means to an end, not an end in itself

Data needs should be informed by the objectives of transformation

Tsai, Y. S., Moreno-Marcos, P. M., Jivet, I., Scheffel, M., Tammets, K., Kollom, K., & Gašević, D. (2018). The SHEILA framework: Informing institutional strategies and policy processes of learning analytics. *Journal of Learning Analytics*, *5*(3), 5-20.

Data quality can’t be fixed with AI (garbage-in-garbage-out)

Gašević, D., Tsai, Y-S., Dawson, S., & Pardo, A. (2019). How do we start? An approach to learning analytics adoption in higher education. *International Journal of Information and Learning Technology, 36*(4), 342-353.

Key point

Creative data sourcing

Key point

Embedding data collection intent into learning and educational designs

Bakharia, A., Corrin, L., De Barba, P., Kennedy, G., Gašević, D., Mulder, R., ... & Lockyer, L. (2016). A conceptual framework linking learning design with learning analytics. In *Proceedings of the sixth international conference on learning analytics & knowledge* (pp. 329-338).

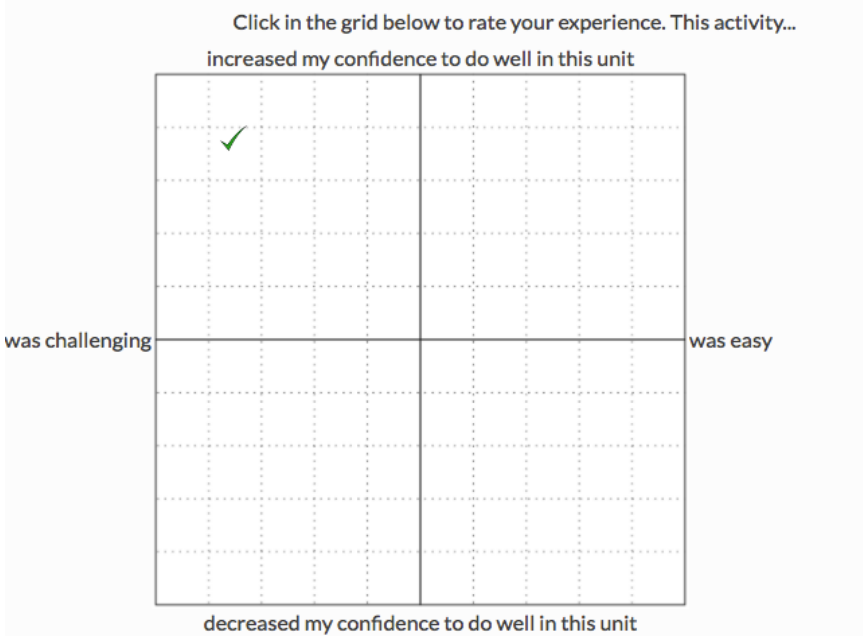
Direction

Pedagogically-valuable instrumentation tools

van der Graaf, J., Lim, L., Fan, Y., Kilgour, J., Moore, J., Bannert, M., ... & Molenaar, I. (2021). Do instrumentation tools capture self-regulated learning?. In *Proceedings of the 11th international learning analytics and knowledge conference* (pp. 438-448).

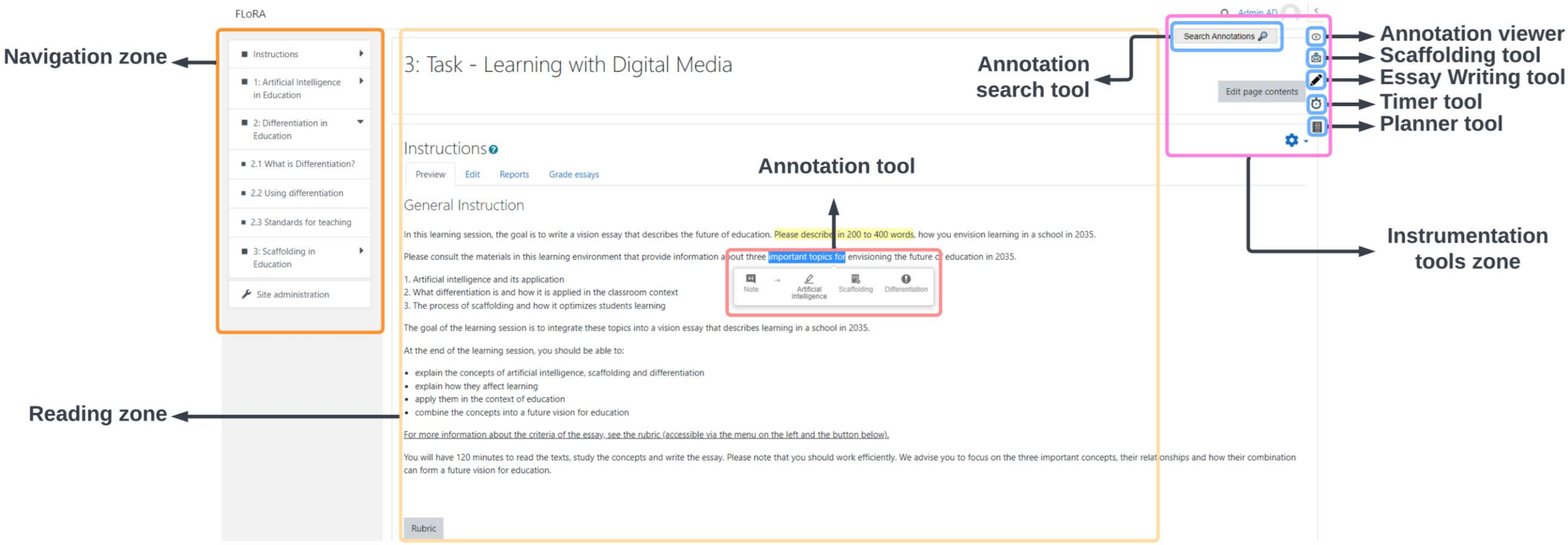
Introduction meaning to clicks

Just-in-time self-reporting



Jovanović, J., Gašević, D., Pardo, A., Dawson, S., & Whitelock-Wainwright, A. (2019). Introducing meaning to clicks: Towards traced-measures of self-efficacy and cognitive load. In *Proceedings of the 9th International Conference on Learning Analytics & Knowledge* (pp. 511-520).

Specialized instrumentation tools



moodle + hypothes.is + extensions

https://floraproject.org

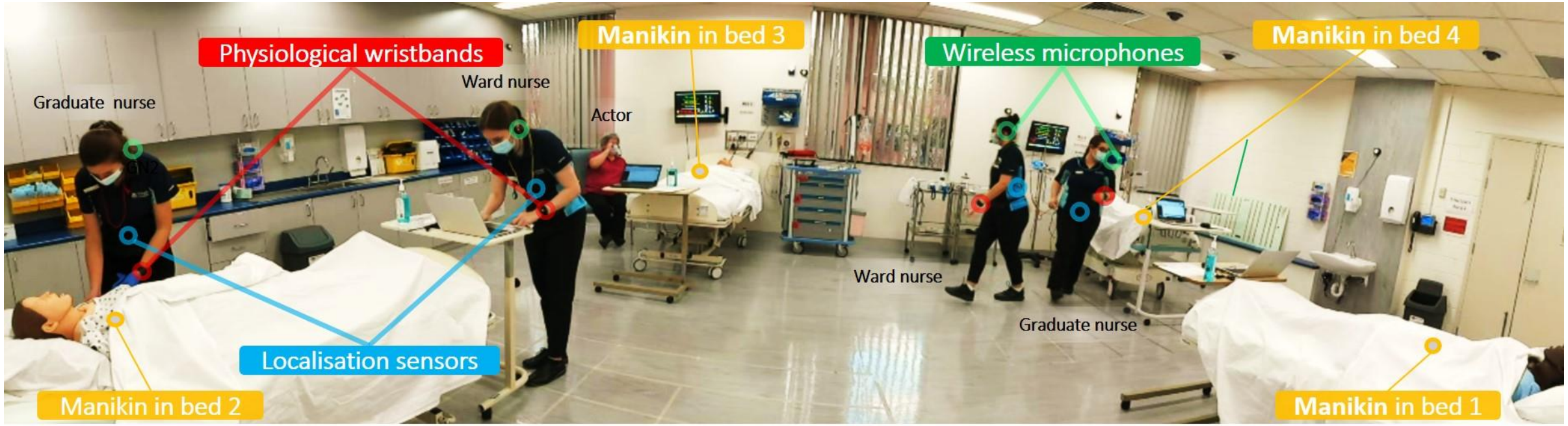
Direction

Using multimodal data

In digital and physical spaces

Fan, Y., Lim, L., van der Graaf, J., Kilgour, J., Raković, M., Moore, J., ... & Gašević, D. (2022). Improving the measurement of self-regulated learning using multi-channel data. *Metacognition and Learning*, 1-31.

Multimodal sensing technologies for teamwork



Echeverria, V., Martinez-Maldonado, R., Yan, L., Zhao, L., Gašević, D., Fernandez-Nieto, G., Buckingham Shum, S. (2023). HuCETA: A Framework for Human-Centred Embodied Teamwork Analytics. *IEEE Pervasive Computing*, in press.

Responsible

Do our data offer equitable representation?

DATA – **MODEL** – TRANSFORMATION –
FINAL REMARKS

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Common modeling tasks

Prediction and description of outcomes and processes

Guiding principle

Question-driven approach to building models that inform practice

Gašević, D., Dawson, S., Rogers, T., Gašević, D. (2016). Learning analytics should not promote one size fits all: The effects of course-specific technology use in predicting academic success. *The Internet and Higher Education, 28*, 68–84.

Learning context

Context shapes the generalizability of data analysis

What shapes generalizability?

Instructional conditions shape learning analytics results

Gašević, D., Dawson, S., Rogers, T., Gašević, D. (2016). Learning analytics should not promote one size fits all: The effects of course-specific technology use in predicting academic success. *The Internet and Higher Education, 28*, 68–84.

What shapes generalizability?

Students matter the most in learning analytics

Jovanović, J., Saqr, M., Joksimović, S., & Gašević, D. (2021). Students matter the most in learning analytics: The effects of internal and instructional conditions in predicting academic success. *Computers & Education, 172*, 104251.

Opportunity

Analytics of learning strategies

Analysis methods

Analytics of learning strategies

Unsupervised machine learning

+

Sequence mining

Process mining

Network analysis

Analytics of learning strategies

Regulation of strategies is consistent with relevant theory

Gašević, D., Jovanović, J., Pardo, A., & Dawson, S. (2017). Detecting Learning Strategies with Analytics: Links with Self-reported Measures and Academic Performance. *Journal of Learning Analytics*, *4*(2), 113–128.

Key findings (2/2)

Analytics of learning strategies

Strategies are predictive of academic performance

Fincham, O. E., Gašević, D., Jovanovic, J. M., & Pardo, A. (2019). From Study Tactics to Learning Strategies: An Analytical Method for Extracting Interpretable Representations. *IEEE Transactions on Learning Technologies*, *12*(1), 59–72. https://doi.org/10.1109/TLT.2018.2823317

Responsible

Thinking beyond accuracy for model *fairness*

Sha, L., Raković, M., Das, A., Gašević, D., & Chen, G. (2022). Leveraging Class Balancing Techniques to Alleviate Algorithmic Bias for Predictive Tasks in Education. *IEEE Transactions on Learning Technologies, 15*(4), 481-492.

Is ChatGPT based on a fair algorithm?

Sha, L., Li, Y., Gasevic, D., & Chen, G. (2022). Bigger Data or Fairer Data? Augmenting BERT via Active Sampling for Educational Text Classification. In *Proceedings of the 29th International Conference on Computational Linguistics* (pp. 1275-1285).

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Responsible

Do the results of models reflect and even perpetuate bias?

Responsible

Explainable analytics to produce actionable insights

Khosravi, H., Shum, S. B., Chen, G., Conati, C., Tsai, Y. S., Kay, J., ... & Gašević, D. (2022). Explainable artificial intelligence in education. *Computers and Education: Artificial Intelligence, 3*, 100074.

DATA– MODEL – **TRANSFORMATION** –
FINAL REMARKS

Learning analytics

Transformation closes the learning analytics feedback loop

Gašević, D., Tsai, Y-S., Dawson, S., & Pardo, A. (2019). How do we start? An approach to learning analytics adoption in higher education. *International Journal of Information and Learning Technology, 36*(4), 342-353.

Learning analytics

Dashboards

Matcha, W., Ahmad Uzir, N., Gašević, D., Pardo, A. (2020). A Systematic Review of Empirical Studies on Learning Analytics Dashboards: A Self-Regulated Learning Perspective. *IEEE Transactions on Learning Technologies, 13*(2), 226 - 245.

Learning analytics

Dashboards can be harmful

Matcha, W., Ahmad Uzir, N., Gašević, D., Pardo, A. (2020). A Systematic Review of Empirical Studies on Learning Analytics Dashboards: A Self-Regulated Learning Perspective. *IEEE Transactions on Learning Technologies, 13*(2), 226 - 245.

Learning analytics

Analytics shouldn’t be easy way to offload accountability

Swiecki, Z., Khosravi, H., Chen, G., Martinez-Maldonado, R., Lodge, J. M., Milligan, S., ... & Gašević, D. (2022). Assessment in the age of artificial intelligence. *Computers and Education: Artificial Intelligence*, *3*, 100075.

Dilemma

Who controls decision-making – humans vs machines?

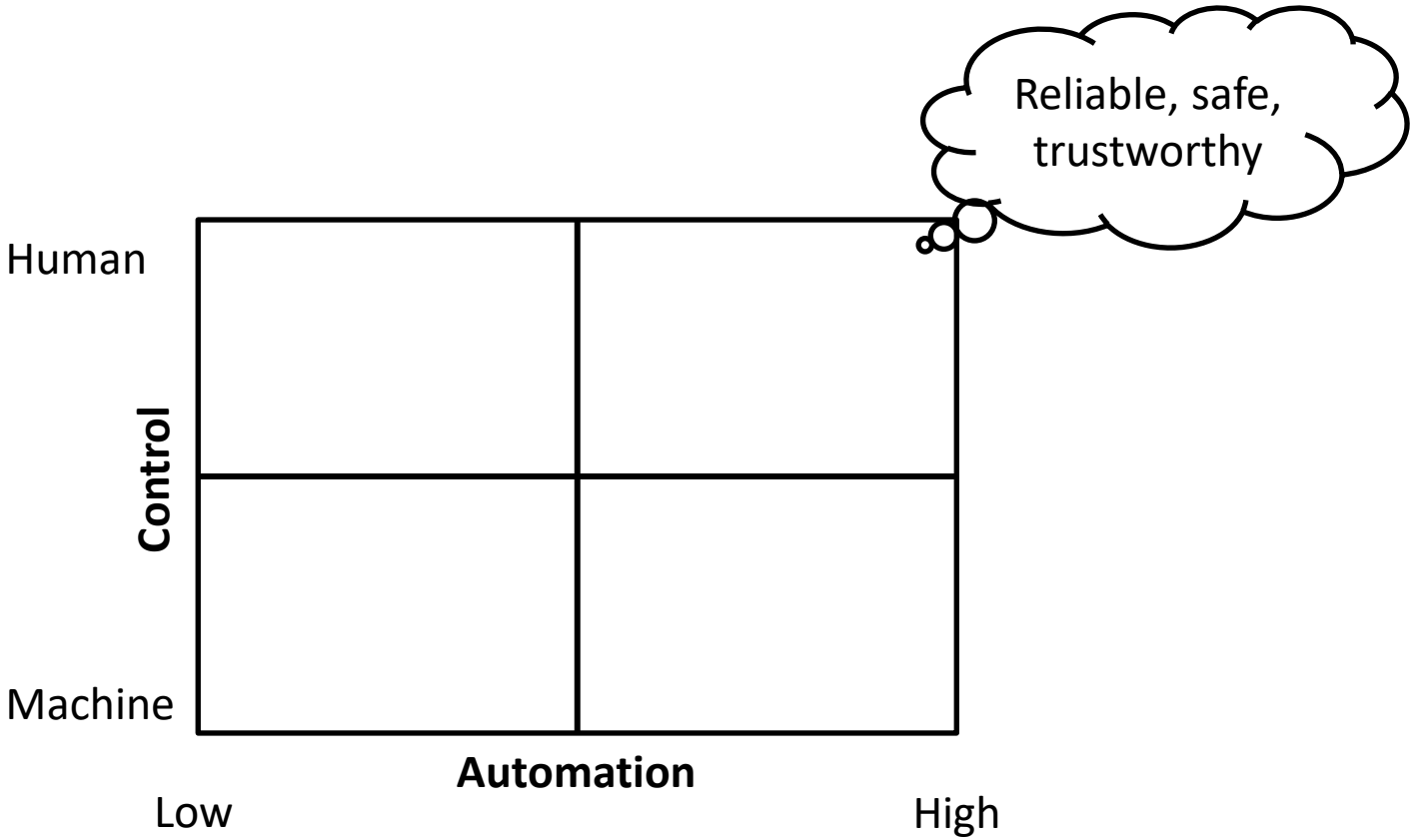
Shneiderman, B. (2022). *Human-Centered Artificial Intelligence*. Oxford University Press

Direction

Analytics in the loop
(human is already in the loop!)

Shneiderman, B. (2022). *Human-Centered Artificial Intelligence*. Oxford University Press

Direction



Shneiderman, B. (2022). *Human-Centered Artificial Intelligence*. Oxford University Press

Direction

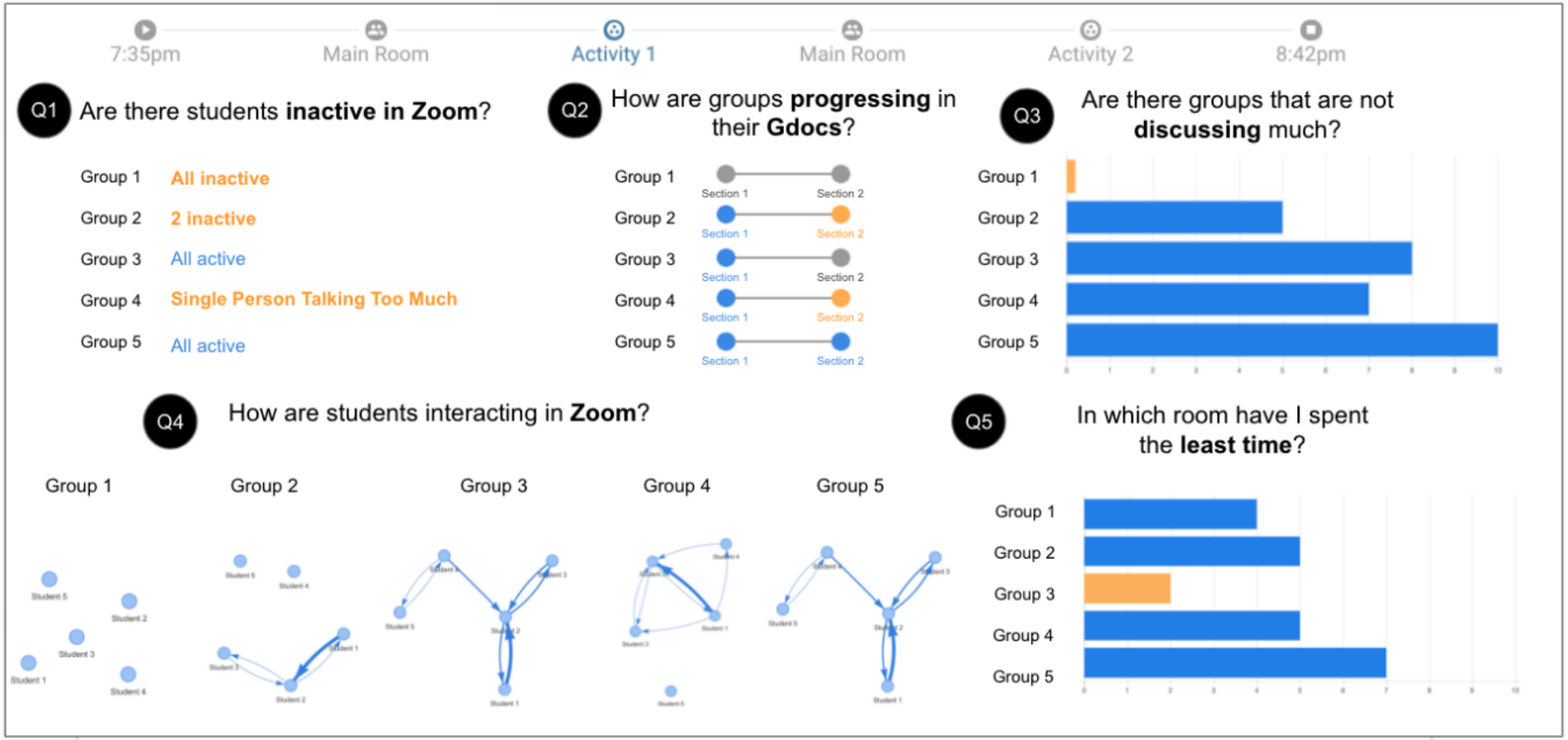
Participatory and co-design is gaining momentum

Sarmiento, J. P., & Wise, A. F. (2022). Participatory and Co-Design of Learning Analytics: An Initial Review of the Literature. In *Proceedings of the 12th International Learning Analytics and Knowledge Conference* (pp. 535-541).

ZoomSense

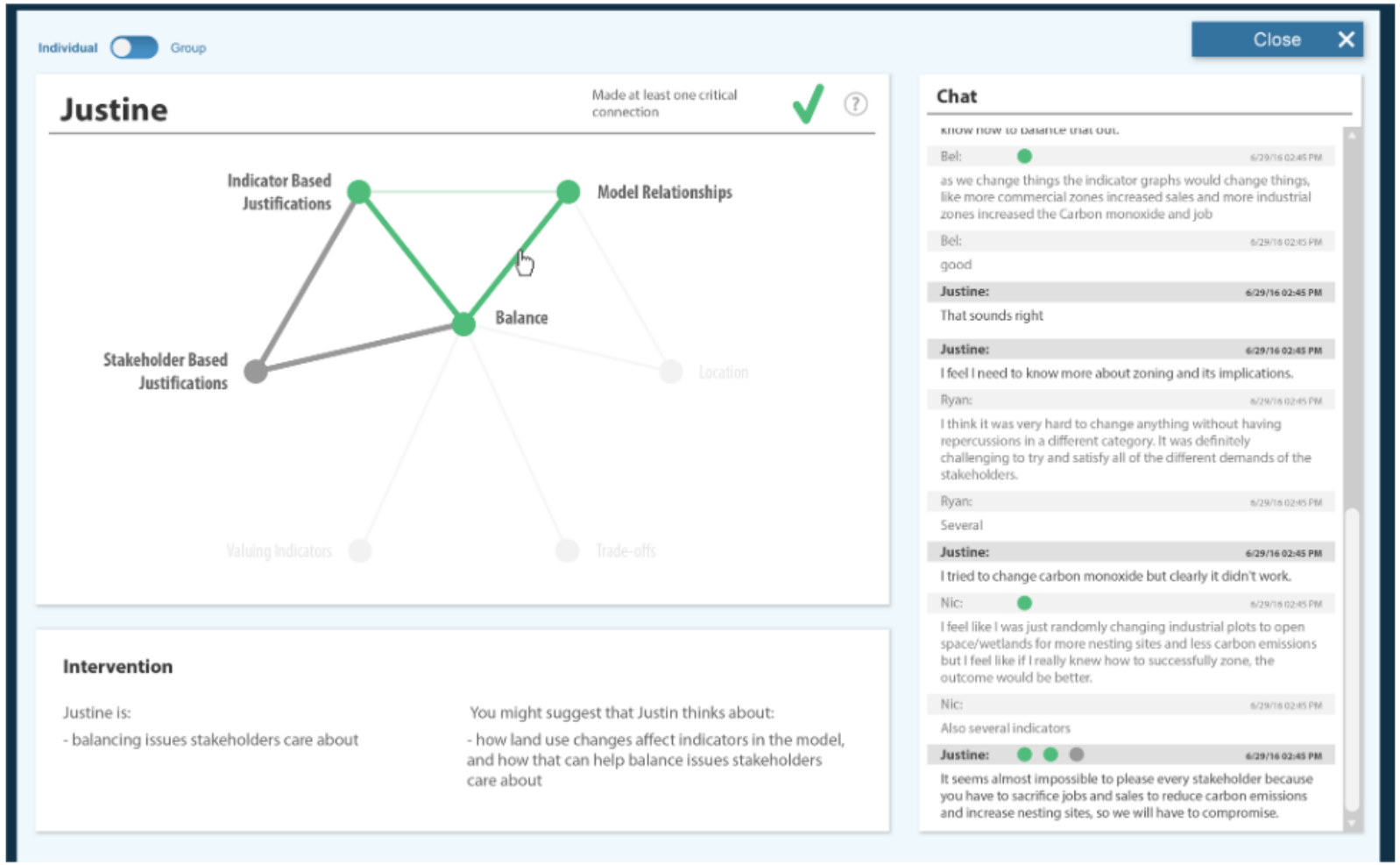
https://zoomsense.io

Question-driven data storytelling



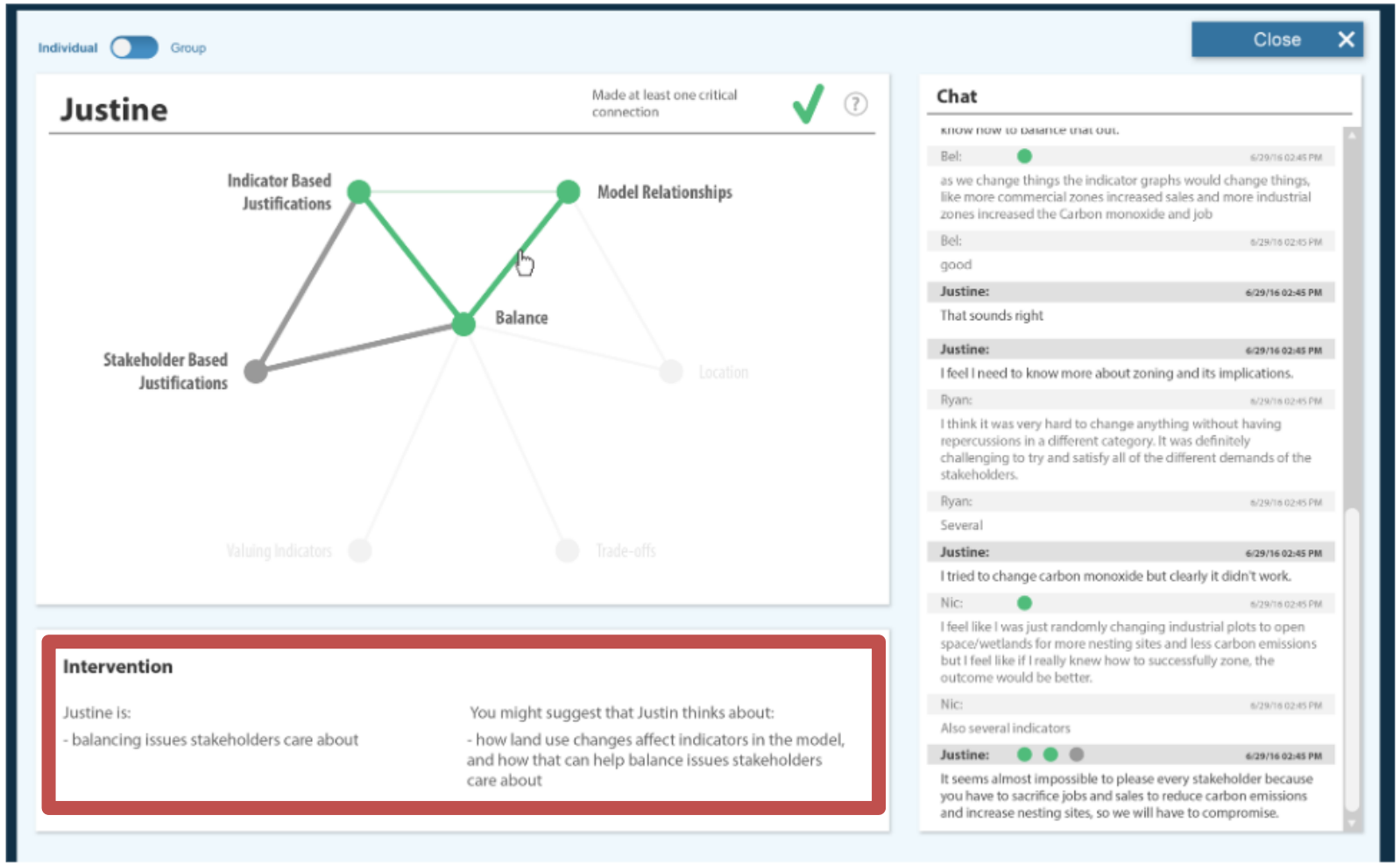
Pozdniakov, S., Martinez-Maldonado, R., Tsai, Y. S., Cukurova, M., Bartindale, T., Chen, P., ... & Gasevic, D. (2022). The Question-driven Dashboard: How Can We Design Analytics Interfaces Aligned to Teachers' Inquiry?. In *Proceedings of the 12th International Learning Analytics and Knowledge Conference* (pp. 175-185).

Recommendations for teachers



Martinez-Maldonado, R., Gašević, D., Echeverria, V., Fernandez Nieto, G., Swiecki, Z., & Buckingham Shum, S. (2021). What Do You Mean by Collaboration Analytics? A Conceptual Model. *Journal of Learning Analytics*, *8*(1), 126-153.

Recommendations for teachers



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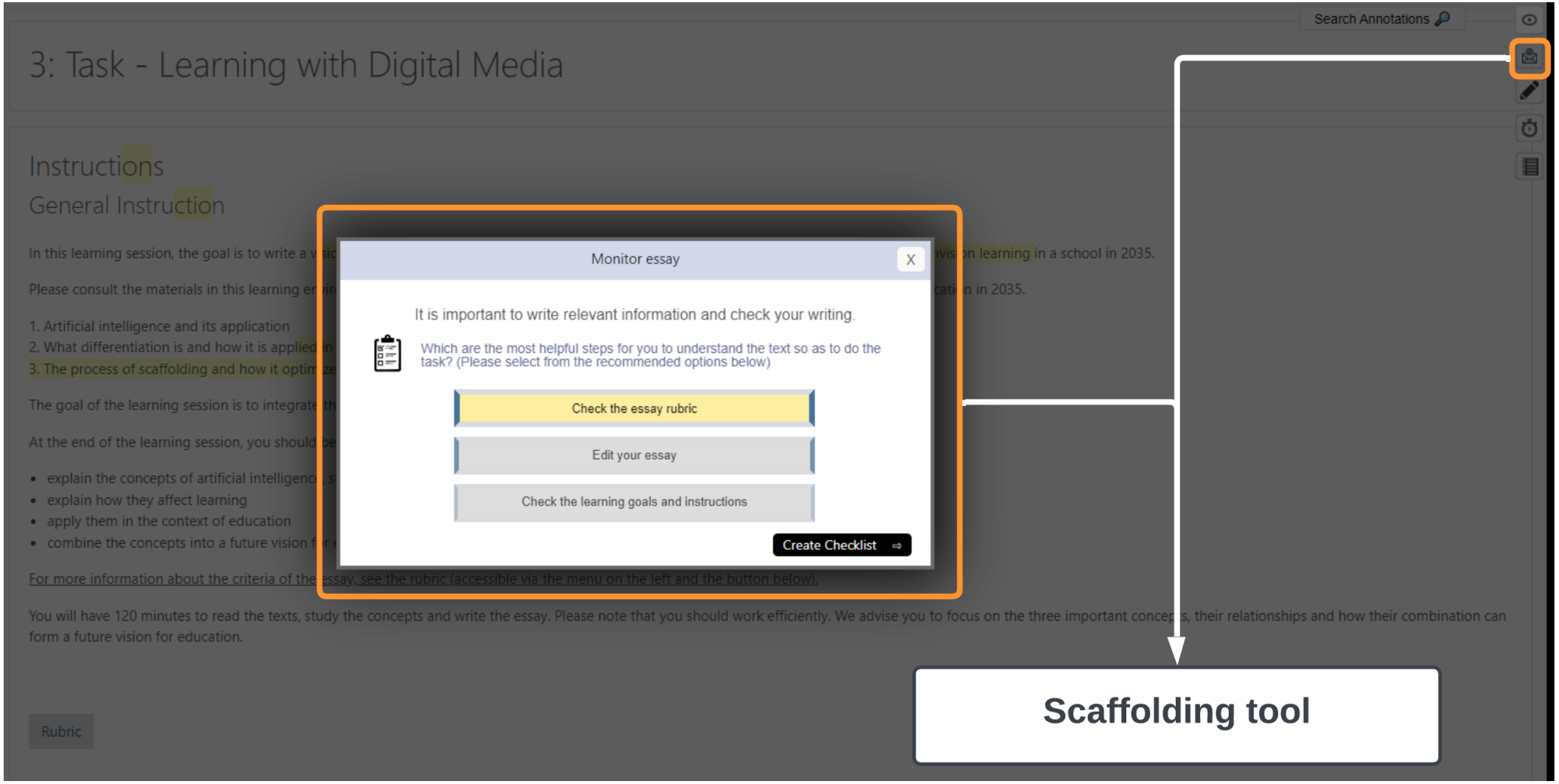
Analytics-based personalized scaffolding



Srivastava, N., Fan, Y., Rakovic, M., Singh, S., Jovanovic, J., Van Der Graaf, J., ... & Gasevic, D. (2022). Effects of Internal and External Conditions on Strategies of Self-regulated Learning: A Learning Analytics Study. In *Proceedings of 12th International Learning Analytics and Knowledge Conference* (pp. 392-403).

Open challenge in quality

Integrating personalized scaffolds into task design

Fan, Y., Li, T., Tsai, Y-S., Rakovic, M., Singh, S., Li, X.,… Gašević, D. (2022). How learners perceive and benefit from personalised SRL scaffoldings: a qualitative study. *Journal of Computer Assisted* learning, submitted.

Open challenge in quality

Integrating personalized scaffolds into task design

No evidence that automatic feedback eases instructors' workload

Cavalcanti, A. P., Diego, A., Carvalho, R., Freitas, F., Tsai, Y. S., Gašević, D., & Ferreira Mello, R. (2021). Automatic feedback in online learning environments: A systematic literature review. *Computers and Education: Artificial Intelligence*, 2, 100027.

Responsibility

Dashboards need to recognize factors of diversity, equity, and inclusion

Williamson, K., & Kizilcec, R. F. (2021). Learning Analytics Dashboard Research Has Neglected Diversity, Equity and Inclusion. In *Proceedings of the Eighth ACM Conference on Learning@ Scale* (pp. 287-290).

Responsibility

How do stakeholders sensemake data about diversity, equity, and inclusion?

Williamson, K., & Kizilcec, R. F. (2021). Learning Analytics Dashboard Research Has Neglected Diversity, Equity and Inclusion. In *Proceedings of the Eighth ACM Conference on Learning@ Scale* (pp. 287-290).

Responsibility

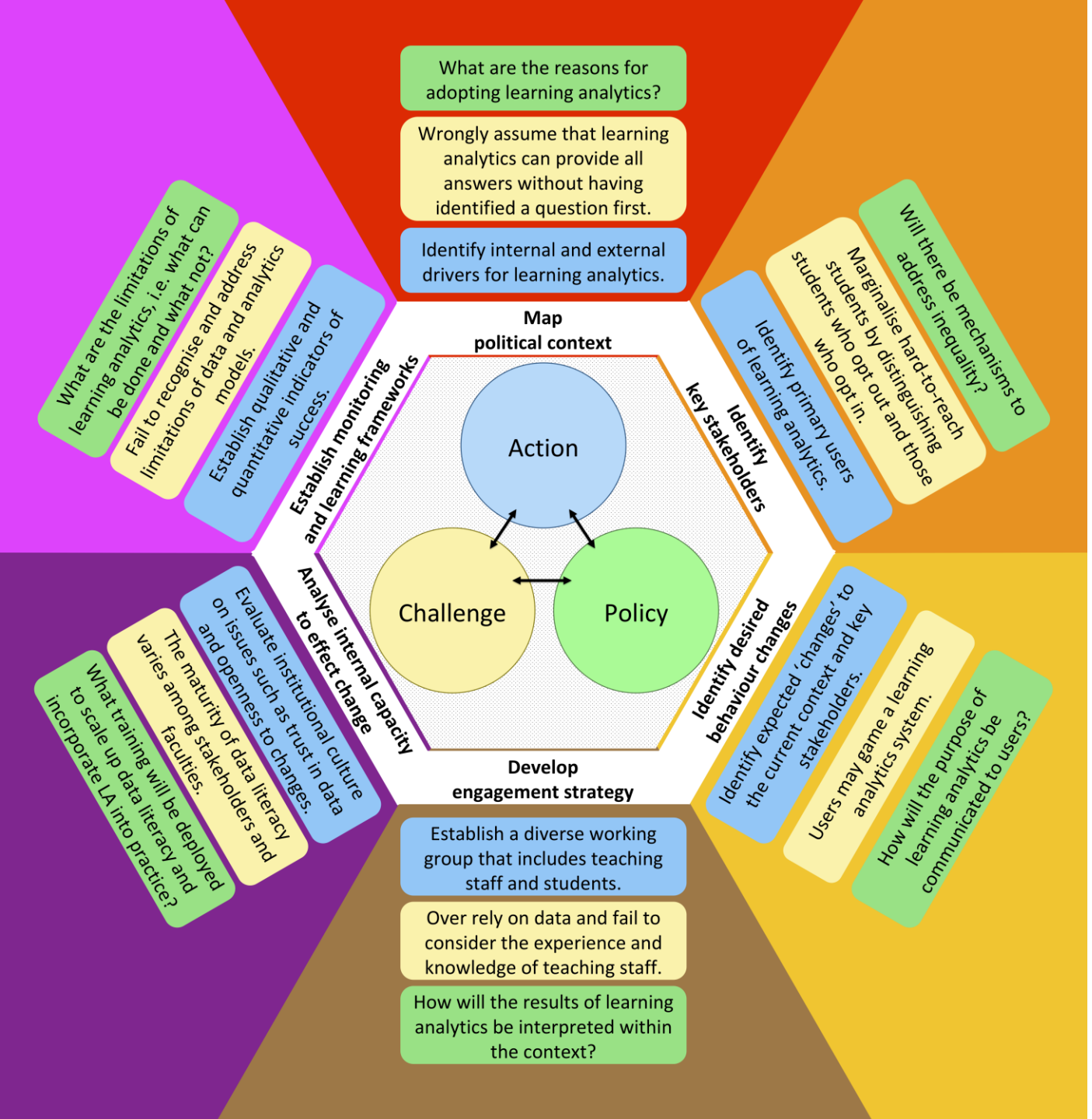
Who takes responsibility for actions taken based on analytics?

Williamson, K., & Kizilcec, R. F. (2021). Learning Analytics Dashboard Research Has Neglected Diversity, Equity and Inclusion. In *Proceedings of the Eighth ACM Conference on Learning@ Scale* (pp. 287-290).

Critical for transformation

Don’t every underestimate social and organizational complexity

Macfadyen, L. P., Dawson, S., Pardo, A., & Gašević, D. (2014). Embracing big data in complex educational systems: The learning analytics imperative and the policy challenge. Research & Practice in Assessment, 9, 17-28.



Learning Technologist of the Year 2019
Winner

SHEILA framework

Formation of institutional strategies and policies for learning analytics

https://sheilaproject.eu/

TOPICS – DATA– MODEL – TRANSFORMATION –

FINAL REMARKS

Data needs driven by the objectives of pedagogical transformation

Predictive accuracy is not enough without fairness

Transformation is enabled by human-centred design

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