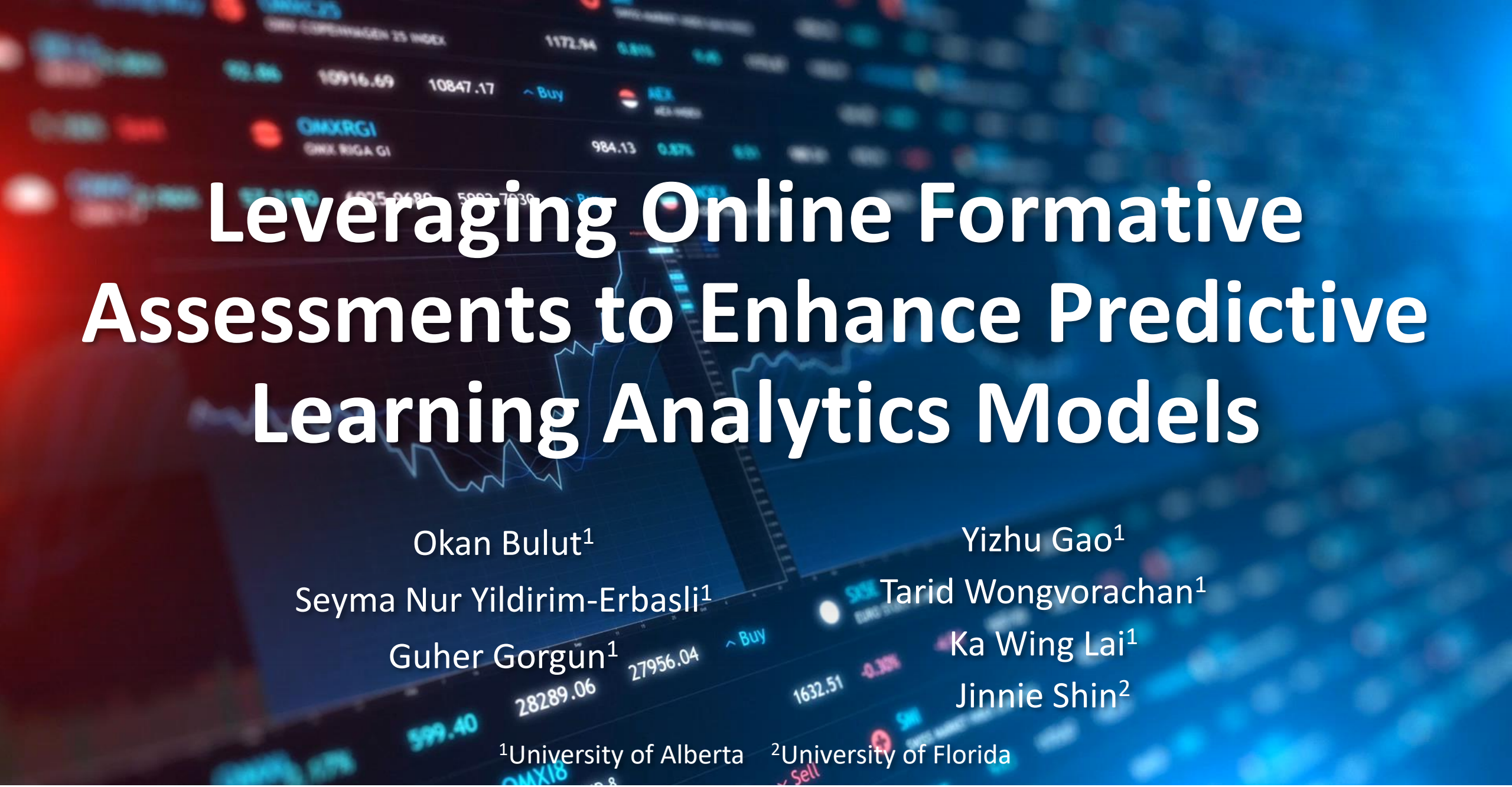

Leveraging Online Formative Assessments to Enhance Predictive Learning Analytics Models

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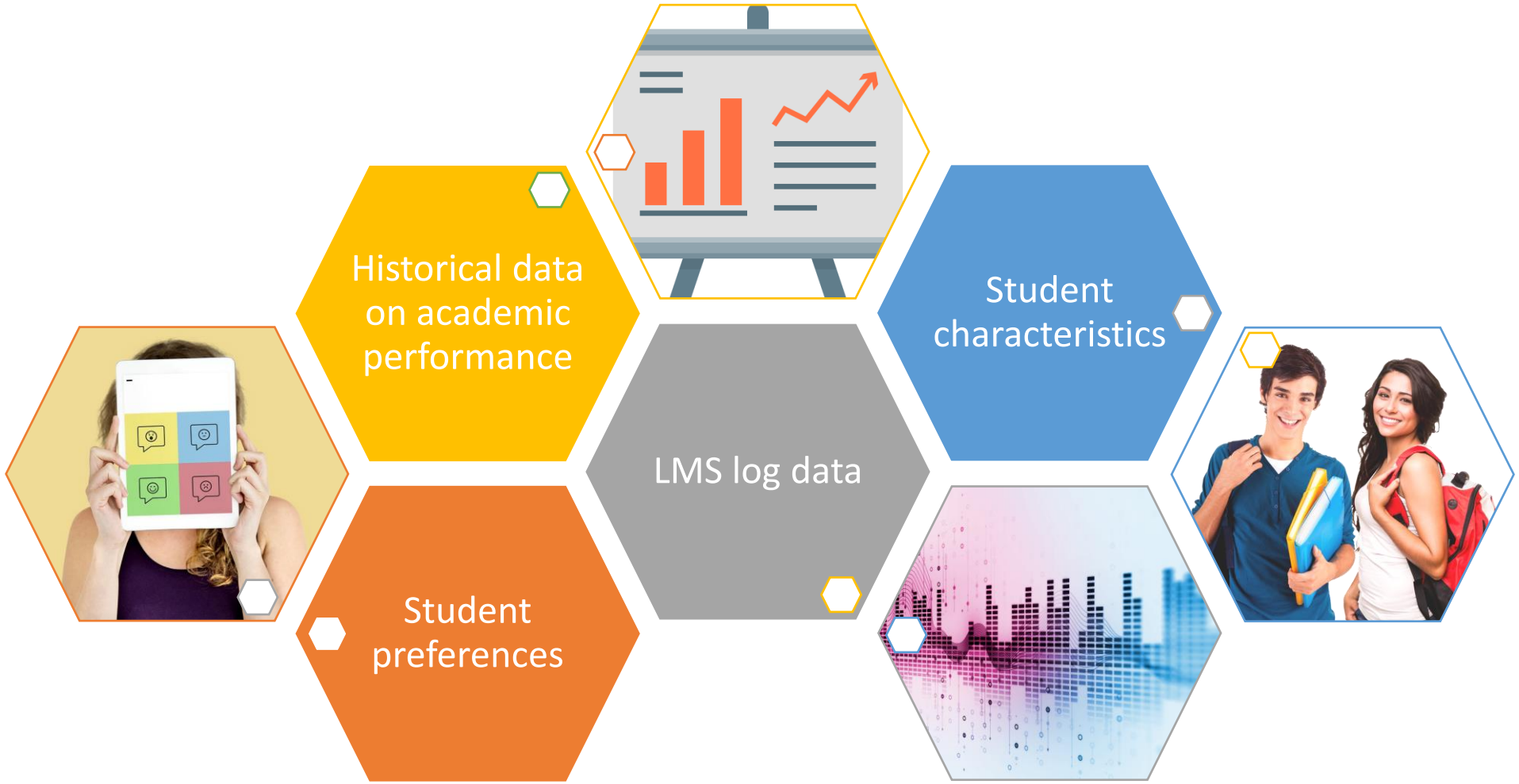
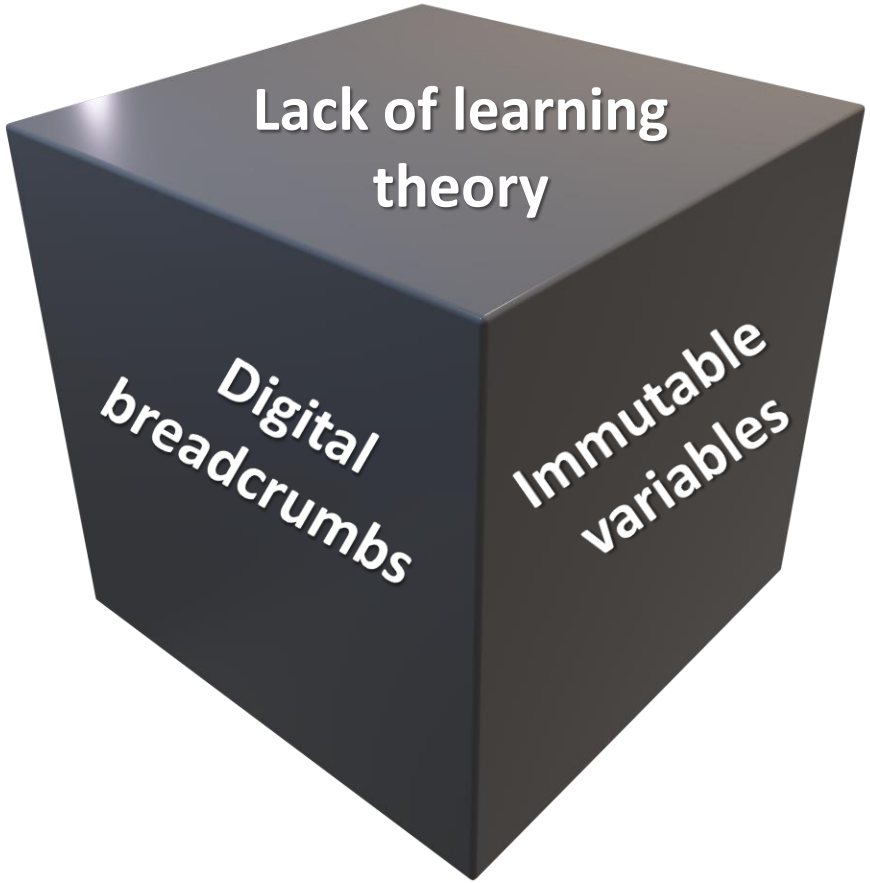
Learning Analytics → Prediction of Academic Performance

[Some] Predictors of Student Learning



“**Black-Box**” Models of Learning



Learning analytics must be about learning (Gašević et al., 2015).

[Online] Formative Assessments

Monitoring students' progress

Providing students with feedback

Adjusting instructional strategies

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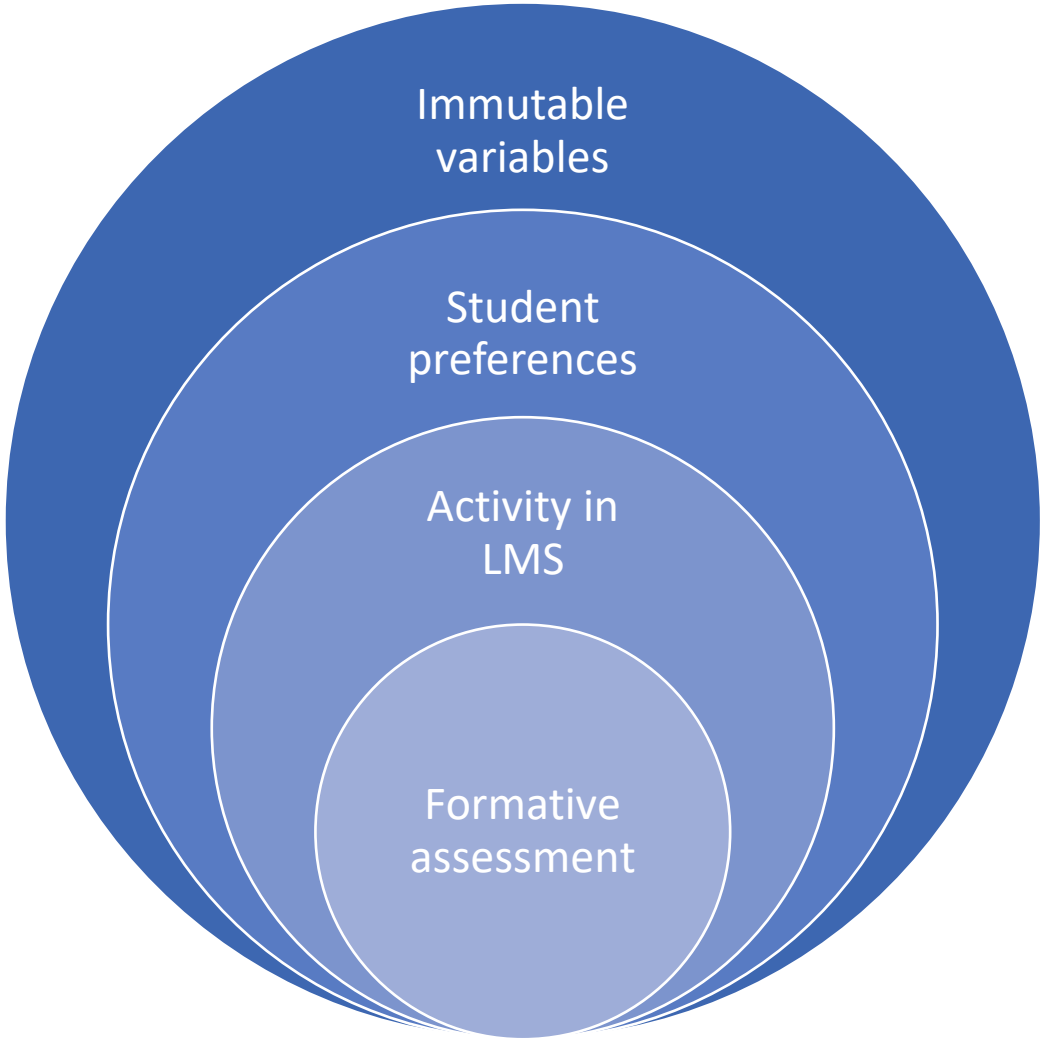
Grades/completion records

Frequency of test attempts

Time spent on formative assessments

Progress throughout the semester

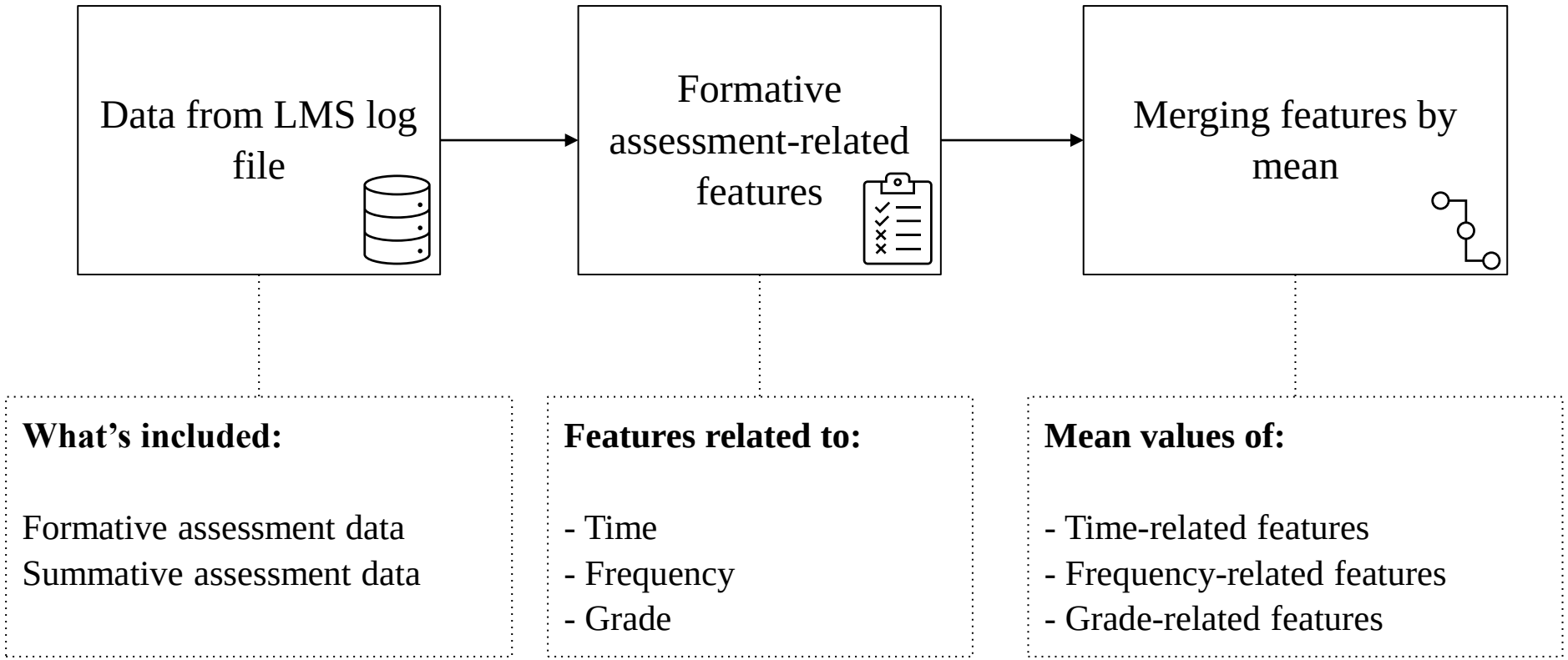


Our Study

An asynchronous, undergraduate course for pre-service teachers

- **Instructor A (Fall 2020, *n* = 198)**
  - 10 online formative quizzes (2-point scale)
- **Instructor A (Fall 2021, *n* = 234)**
  - 11 online formative quizzes (4-point scale)
- **Instructor B (Fall 2021, *n* = 123)**
  - 5 formative quizzes (auto-scored, unlimited attempts) + 5 learning activities (self-graded)

Feature Extraction & Statistical Modeling



Goal: To predict students' final course performance using extracted features
Method: Stepwise regression with forward selection (for each class)

Results (1)

Extracted Features	Instructor A (Fall 2020) (*n* = 198)	Instructor A (Fall 2021) (*n* = 234)	Instructor B (Fall 2021) (*n* = 123)
Formative assessment performance (*M*)	0.69	0.71	0.73
Formative assessment performance (*SD*)	-0.52	-0.55	-0.22
Total clicks	0.32	0.22	0.22
Time difference before due date (*M*)	0.24	0.31	0.40
Time difference after quiz availability (*M*)	-0.40	-0.32	-0.37
Time taken to complete the quiz (*M*)	-0.03	-0.04	0.07
Number of attempts (*M*)	0.08	0.02	0.17

Note: *M* = Mean values. *SD* = Standard deviation values.

Results (2)

Instructor A with formative quizzes (graded)

1. Average formative assessment scores (R^2 = 0.48 – 0.51)
2. Number of clicks in formative assessments (R^2 = 0.49)

Instructor B with formative quizzes/activities (auto-scored or self-graded)

1. Average formative assessment scores (R^2 = 0.49)
2. Time difference between first attempt and due date (R^2 = 0.55)
3. Number of clicks in formative assessments (R^2 = 0.56)

Final Remarks

Conclusions:

- Online formative assessments predict final course performance very well.
- The number of clicks (i.e., engagement with formative assessments) is an important secondary predictor.
- Time-related predictors become more important when course materials are released sequentially (*rather than all course materials are released at once*).

Future Directions:

- Using performance by content areas in prediction LA models (to better inform instructors)
- Impact of accessing (formative) exam reports on final course performance (Bulut et al., 2019)
- Using predictive LA models to inform students' feedback-based action plan

Thank You!

https://bit.ly/LAK22Formative