

# Leveraging Online Formative Assessments to Enhance Predictive Learning Analytics Models

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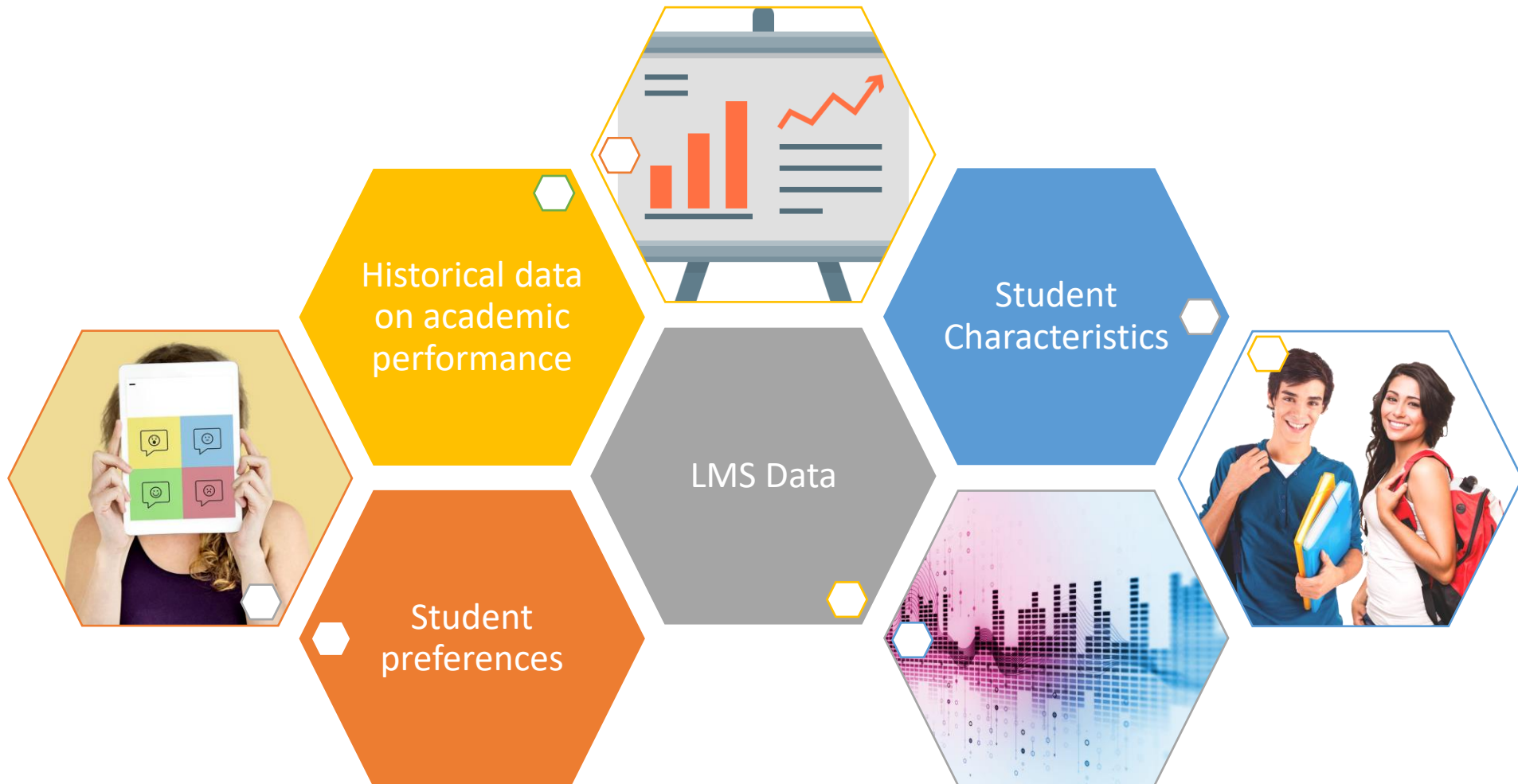
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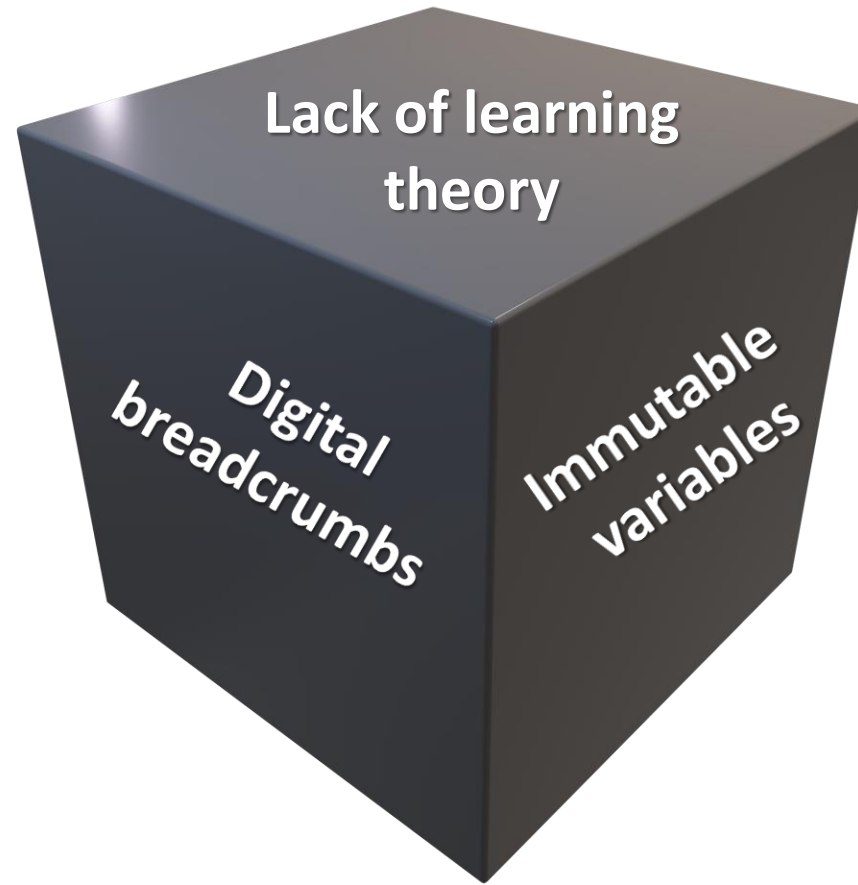
# Learning Analytics → Prediction of Academic Performance



# [Some] Predictors of Student Learning



# “Black-Box” Models of Learning



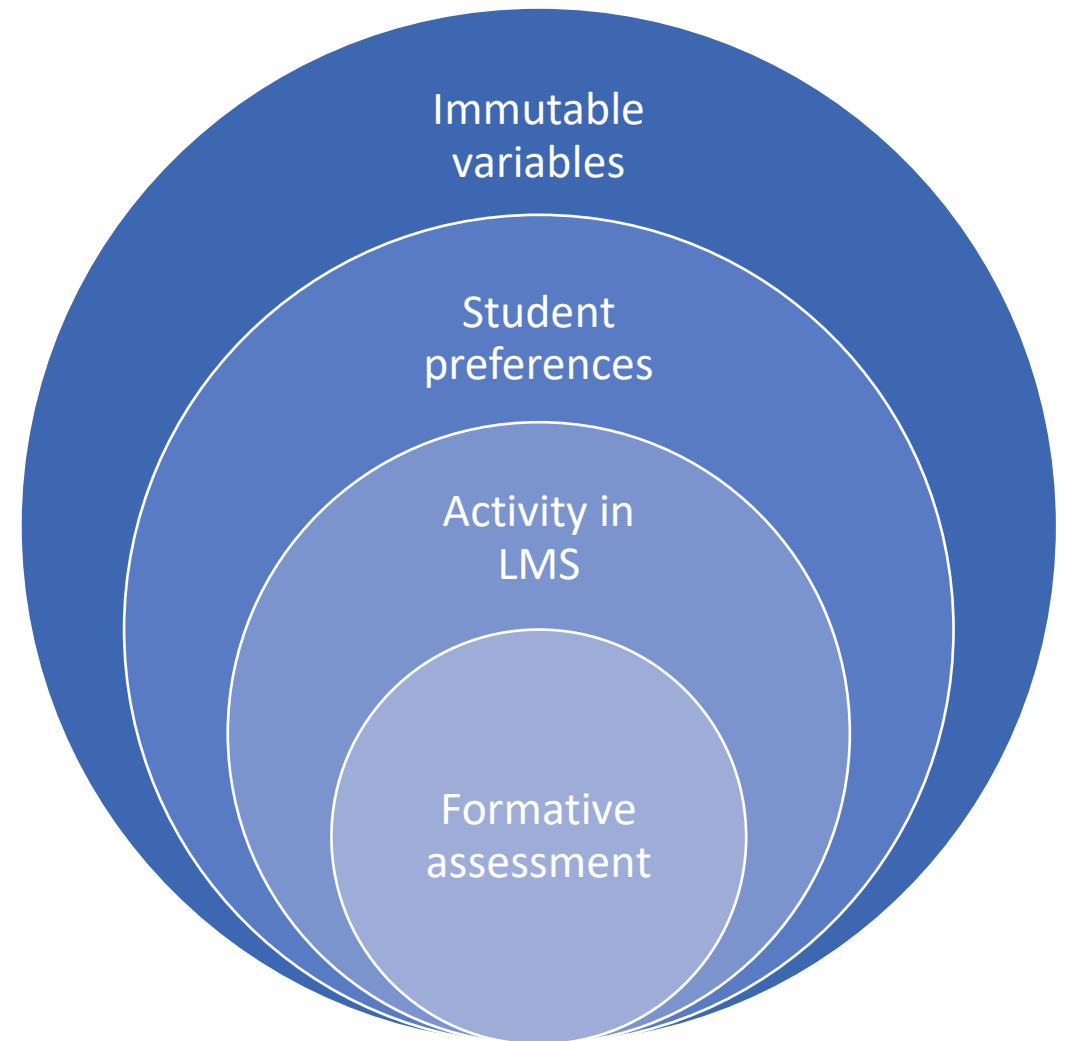
**Learning analytics** must be about **learning** ([Gašević et al., 2015](#)).

# [Online] Formative Assessments

Monitoring students' progress  
Providing students with feedback  
Adjusting instructional strategies

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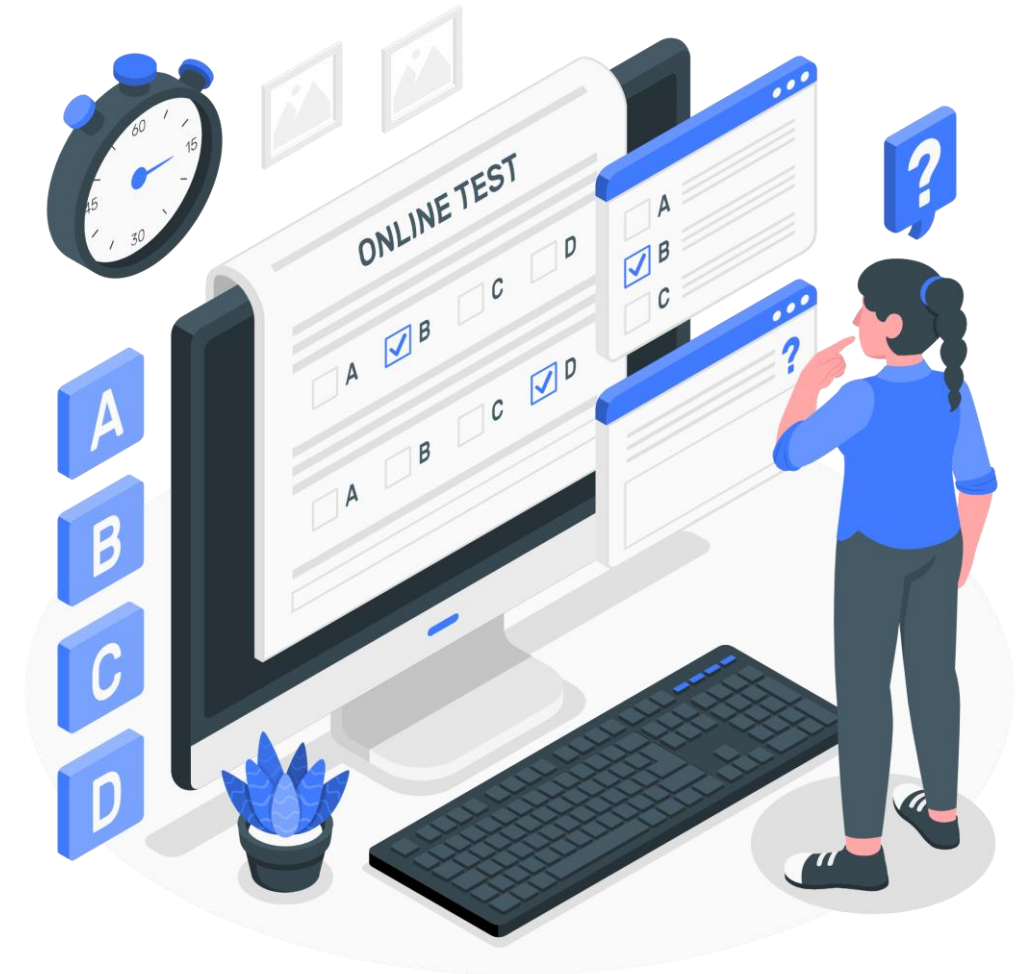
Grades/completion records  
Frequency of test attempts  
Time spent on formative assessments  
Progress throughout the semester



# Our Study

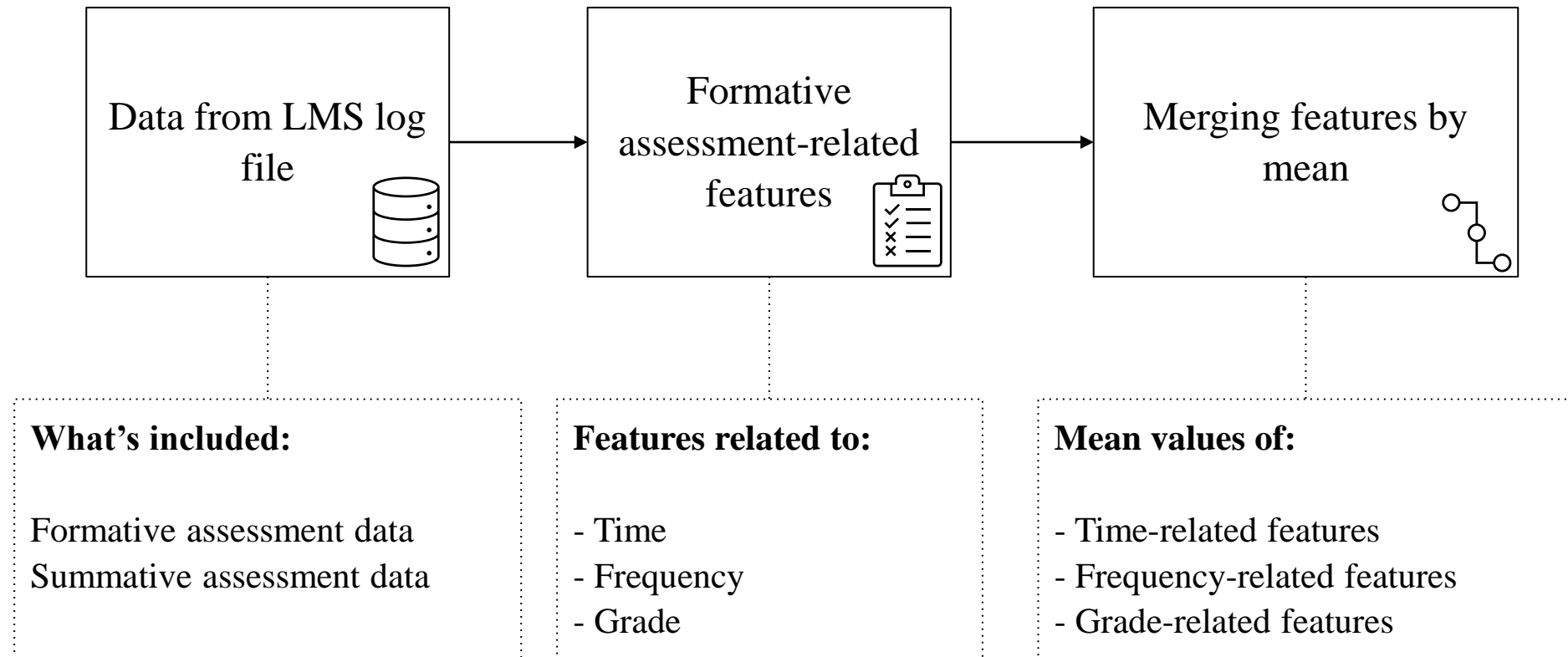
An asynchronous, undergraduate course for pre-service teachers

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



# 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!