

Learning Analytics Concepts

EME 6651

Location: Online

Academic Term: Spring 2023

Instructor:

<PROF_FIRST_NAME>

<PROF_LAST_NAME>, Ph.D.

<PROF_EMAIL>

<LINK_DESCRIPTOR>

<PHONE>

Office Hours: Office hours will be provided in-person or through Zoom upon request to accommodate the online and asynchronous format of the course. Please contact me through Canvas or email if you would like to set up a time; in requesting office hours, please articulate the question you have or provide context for what you would like to discuss, as well as provide your availability for scheduling purposes.

Course Description

This course is designed to equip students with the ability to leverage educational data collected from technology-enhanced learning environments. In addition to the basic concept and process of learning analytics, students will explore cutting-edge data mining techniques. Students will also have opportunities to process and analyze various types of real-world educational data to discover useful insights and knowledge. The ultimate goal of this course is to prepare students to be a successful educational researcher and practitioner who is able to use learning analytics in their specific subject area.

Course Deliverables

- *Analytics assignments:* There are **four** analytics assignments in this course aligned to the learning objectives and readings. These project-based assignments will involve students applying analytics methods and models to draw inferences from real-world education datasets. Students will submit the data used for the assignment (along with any modifications made), the RapidMiner process, as well as a minimum 1-page report describing their methods and interpretations of results.
- *Reflections/Critiques:* There are **eight** graded discussions within the course aligned to the learning objectives and readings. Students will be required to post a reflection and critique of a provided reading in the area of learning analytics.

Course Pre-Requisites / Co-Requisites

- This course has no pre-requisites and assumes no prior knowledge of analytics or programming

Course Objectives

Upon successful completion of this course, students will:

- Demonstrate an understanding of the distinction between learning analytics and traditional data analysis approaches.
- Describe the characteristics of different data-mining techniques.
- Choose a suitable data-mining technique for different types of educational data.
- Interpret a variety of educational data to discover insights into how to enhance teaching and learning.
- Formulate research questions that can be addressed by applying learning analytics.
- Write a research proposal that addresses research questions pertaining to learning analytics

Required Textbooks and Software

There is no required textbook for this course – all readings will be provided through Canvas. The tentative reading list is as follows (subject to change):

- Module 1: Baker, R., Siemens, G. (2022) Educational data mining and learning analytics. In *Sawyer, K. (Ed.) Cambridge Handbook of the Learning Sciences: 3rd Edition*

- **Module 2:** Pavlik, P. I., Cen, H., & Koedinger, K. R. (2009). Performance Factors Analysis--A New Alternative to Knowledge Tracing. In *14th International Conference on Artificial Intelligence in Education*.
- **Module 3:** Bosch, N., & Paquette, L. (2018). Metrics for discrete student models: Chance levels, comparisons, and use cases. *Journal of Learning Analytics*, 5(2), 86-104.
- **Module 4:** Kai, S., Paquette, L., Baker, R. S., Bosch, N., D'Mello, S., Ocumpaugh, J., ... & Ventura, M. (2015). A Comparison of Video-Based and Interaction-Based Affect Detectors in Physics Playground. In *Proceedings of the 2015 International Conference on Educational Data Mining*.
- **Module 5:** Closser, A. H., Erickson, J. A., Smith, H., Varatharaj, A., & Botelho, A. F. (2021). Blending learning analytics and embodied design to model students' comprehension of measurement using their actions, speech, and gestures. *International Journal of Child-Computer Interaction*, 32, 100391.
- **Module 6:** Kizilcec, R. F. & Lee, H. (2022). Algorithmic Fairness in Education. In *W. Holmes & K. Porayska-Pomsta (Eds.), The Ethics of Artificial Intelligence in Education*, Routledge.
- **Module 7:** Piech, C., Bassen, J., Huang, J., Ganguli, S., Sahami, M., Guibas, L. J., & Sohl-Dickstein, J. (2015). Deep knowledge tracing. *Advances in neural information processing systems*, 28.
- **Module 8:** Bodily, R., Kay, J., Aleven, V., Jivet, I., Davis, D., Xhakaj, F., & Verbert, K. (2018, March). Open learner models and learning analytics dashboards: a systematic review. In *Proceedings of the 8th international conference on learning analytics and knowledge* (pp. 41-50).

Supplemental learning materials will be provided, including the following:

- Baker, R.S. (2020) *Big Data and Education*. 6th Edition. Philadelphia, PA: University of Pennsylvania.
 - o Accessible via: <https://learninganalytics.upenn.edu/MOOT/bigdataeducation.html>

You will need access to a modern personal computer and a reliable internet connection. Additionally, we will be using a variety of software packages this semester, including RapidMiner Studio (Educational License; <https://rapidminer.com/educational-program/>), MS office suite (2007 or later), Adobe Reader, and modern browser (Chrome, Firefox, Edge, etc.).

Course Schedule

This course is comprised of 8 modules, each corresponding with a key conceptual topic. Each module will be released at 12a on the corresponding Monday, with module deliverables due at 11:59p on the following Sunday.

Module 1: Overview of Learning Analytics	
Topics: <ul style="list-style-type: none"> - Overview of Learning Analytics - Introduction to RapidMiner - Data Descriptives 	Deliverables: <ul style="list-style-type: none"> - Assignment 1 Released - Reflection 1: Baker & Siemens (2022)
Module 2: Regression and Classification	
Topics: <ul style="list-style-type: none"> - Types of Data - Regression VS Classification - Linear Regression - Logistic Regression 	Deliverables: <ul style="list-style-type: none"> - Assignment 1 Due - Reflection 2: Pavlik, Cen, & Koedinger (2009)

Module 3: Evaluating and Comparing Models	
Topics:	Deliverables:
<ul style="list-style-type: none"> - Tree-based Models - Cross Validation and Overfitting - Evaluation Metrics - Comparing Models 	<ul style="list-style-type: none"> - Assignment 2 Released - Reflection 3: Bosch & Paquette (2018)
Module 4: More Modeling Methods	
Topics:	Deliverables:
<ul style="list-style-type: none"> - Naïve Bayes - Support Vector Machines - Feature Selection 	<ul style="list-style-type: none"> - Assignment 2 Due - Reflection 4: Kai et al. (2015)
Module 5: Unsupervised Learning	
Topics:	Deliverables:
<ul style="list-style-type: none"> - Unsupervised Learning - K-Means Clustering - Model Regularization - Dimensionality Reduction 	<ul style="list-style-type: none"> - Assignment 3 Released - Reflection 5: Closser et al. (2021)
Module 6: Algorithmic Bias and Fairness	
Topics:	Deliverables:
<ul style="list-style-type: none"> - Algorithmic Bias and Fairness - Covariate Shift - Normalization - Sampling and Stratification 	<ul style="list-style-type: none"> - Assignment 3 Due - Reflection 6: Kizilcec & Lee (2022)
Module 7: Neural Networks	
Topics:	Deliverables:
<ul style="list-style-type: none"> - Multi-layer Perceptrons - Feature Embedding - Applications of Deep Learning 	<ul style="list-style-type: none"> - Assignment 4 Released - Reflection 7: Piech et al. (2015)
Module 8: Applications of Learning Analytics	
Topics:	Deliverables:
<ul style="list-style-type: none"> - Dashboards - Knowledge Modeling - Recommendation Systems 	<ul style="list-style-type: none"> - Assignment 4 Due - Reflection 8: Bodily et al. (2018)

Attendance Policy, Class Expectations, and Make-Up Policy

Each module has a designated discussion forum for questions about the module's contents. Students are expected to post their questions about the course contents to the designated module discussion forum. The instructor will monitor activity and provide timely responses to student questions. Personal matters should be directed to the instructor using Canvas messaging. Students are expected to practice professionalism in their communication with their peers and the instructor. This means communications should be respectful and clearly articulated with complete sentences. Please be sure to follow this format for course communications and interactions.

Students are expected to satisfy all course objectives as outlined by the instructor. In an online course, this means logging into the Learning Management System frequently and spending an appropriate amount of time interacting with course materials, along with completing course activities in the sequence prescribed in the syllabus.

In order to receive full credit for work, students must turn in required deliverables on the specified due date. Late work is not accepted except in special circumstances (e.g., religious holidays, military duty, jury duty, etc.) or other extremely unusual circumstances. Extremely unusual circumstances must be discussed with the instructor PRIOR to due dates. Incomplete grades are not given. Please plan accordingly and finish all work during the scope of this course.

Excused absences must be consistent with university policies in the Graduate Catalog (<LINK>) and require appropriate documentation. Additional information can be found here:

<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Evaluation of Grades

Assignment	Percentage of Final Grade
Analytics assignments (4)	80%
Online Reflections (8)	20%
	100%

Grading Policy

Percent	Grade	Grade Points
93.0 - 100.0	A	4.00
90.0 - 92.9	A-	3.67
87.0 - 89.9	B+	3.33
83.0 - 86.9	B	3.00
80.0 - 82.9	B-	2.67
77.0 - 79.9	C+	2.33
73.0 - 76.9	C	2.00
70.0 - 72.9	C-	1.67
67.0 - 69.9	D+	1.33
63.0 - 66.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at: <LINK >

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via **GatorEvals**. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens and can complete evaluations through the email, they receive from **GatorEvals**, in their Canvas course menu under **GatorEvals**, or via <https://gatorevals.aa.ufl.edu/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://catalog.ufl.edu/UGRD/academic-regulations/ferpa-confidentiality-student-records/>

Campus Resources:

Health and Wellness

U Matter, We Care:

If you or a friend is in distress, please contact <EMAIL> or <PHONE> so that a team member can reach out to the student.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and <PHONE>; and the University Police Department: <PHONE> or <PHONE> for emergencies.

Sexual Assault Recovery Services (SARS)

Student Health Care Center, <PHONE>.

University Police Department at <PHONE> (or <PHONE> for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, <PHONE> (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, <PHONE>. Career assistance and counseling. <https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, <PHONE> or <PHONE>. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, <PHONE>. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.

