

Designing an Early Momentum Metrics Dataset to Improve Student Success

Nathan Hodges, Business Intelligence Analyst
Anne Oxenreider, Senior Data Analyst

Session Outcomes

Welcome to our presentation. We are excited to share our experience developing a dataset for advanced analytic applications. Our goal is to bridge the gap between the Early Momentum Metrics (EMM) framework and practical data implementation, focusing on increasing student success.

One

Explain the Early Momentum Metrics (EMM) Framework and its significance in predicting long-term student success in higher education.

Two

Analyze the process of designing and constructing an EMM-based dataset for advanced analytics applications.

Meet Nolan



THE NEED FOR A STUDENT SUCCESS THEORETICAL FRAMEWORK IN IR

Purpose of Request	and staff positions all across campus. Understanding how to increase retention requires that we understand the reason why students are leaving these highly funded sch majors. With limited budgets, remediation measures must be data driven, and we do not have these data. The current dashboard are great for determining how many left and when, but not why, which is required for the development for any strategic remediation plan.
Intended Audience	The CET initially (Pilot), and then all of Academic Affairs after the model is developed.
Timeframe	These data are needed ASAP

Early Momentum Metrics: Why They Matter for College Improvement

By Davis Jenkins and Thomas Bailey

Postsecondary Data Partnership

Measure student outcomes.
Grow student success.

The Postsecondary Data Partnership (PDP) is a nationwide effort to help colleges and universities gain a fuller picture of student progress and outcomes, meet various reporting requirements, and identify where to focus their resources. Both [institutions](#) and [educational organizations](#) can participate in the PDP.

[Watch our video](#) on the exciting enhancements we've made to PDP.



NC

COMMUNITY COLLEGES

CREATING SUCCESS

2024 PERFORMANCE MEASURES **for** STUDENT SUCCESS

Early Momentum Metrics List – General

Credit Momentum	<p>Earned 6+ college credits in first term</p> <p>Earned 12+ college credits in the first term</p> <p>Earned 15+ college credits in the first year</p> <p>Earned 24+ college credits in the first year</p> <p>Earned 30+ college credits in the first year</p>
Gateway Course Momentum	<p>Completed college math in the first year</p> <p>Completed college English in the first year</p> <p>Completed college math & English in the first year</p>
Term Momentum	<p>Persisted from the first term to the second term</p> <p>College credit pass rate</p> <p>Attempted 15+ credits (any level) in the first term</p> <p>Attempted 30+ credits (any level) in the first year</p>
Program Momentum	<p>Earned 9+ credits in major subjects in the first year</p>

**EMM:
4-yr.
College
Students
Key
Findings**

After six years, first-year momentum students:

- Earned 27 more credits
- Nineteen percentage points more likely to earn a degree or certificate (**57% versus 38%**) than non-momentum students.
- **Paid 20% less per degree** in tuition and fees.
- **College expenditures** were 23% less per degree for first-year momentum students.
- First-year momentum students **generated** on average \$4,890 **more in tuition and fees** than non-momentum students.

Belfield, C., Jenkins, D., & Lahr, H. (2016). Momentum: The academic and economic value of a 15-credit first semester course load for college students in Tennessee (CCRC Working Paper No. 88). New York, NY: Columbia University, Teachers College, Community College Research Center.

Early Momentum Metrics List – STEM

Fink, J., Myers, T., Sparks, D., & Jaggars, S. S. (2021). Toward a practical set of STEM transfer program momentum metrics (CCRC Working Paper No. 127). Community College Research Center. (page 17)

STEM Momentum

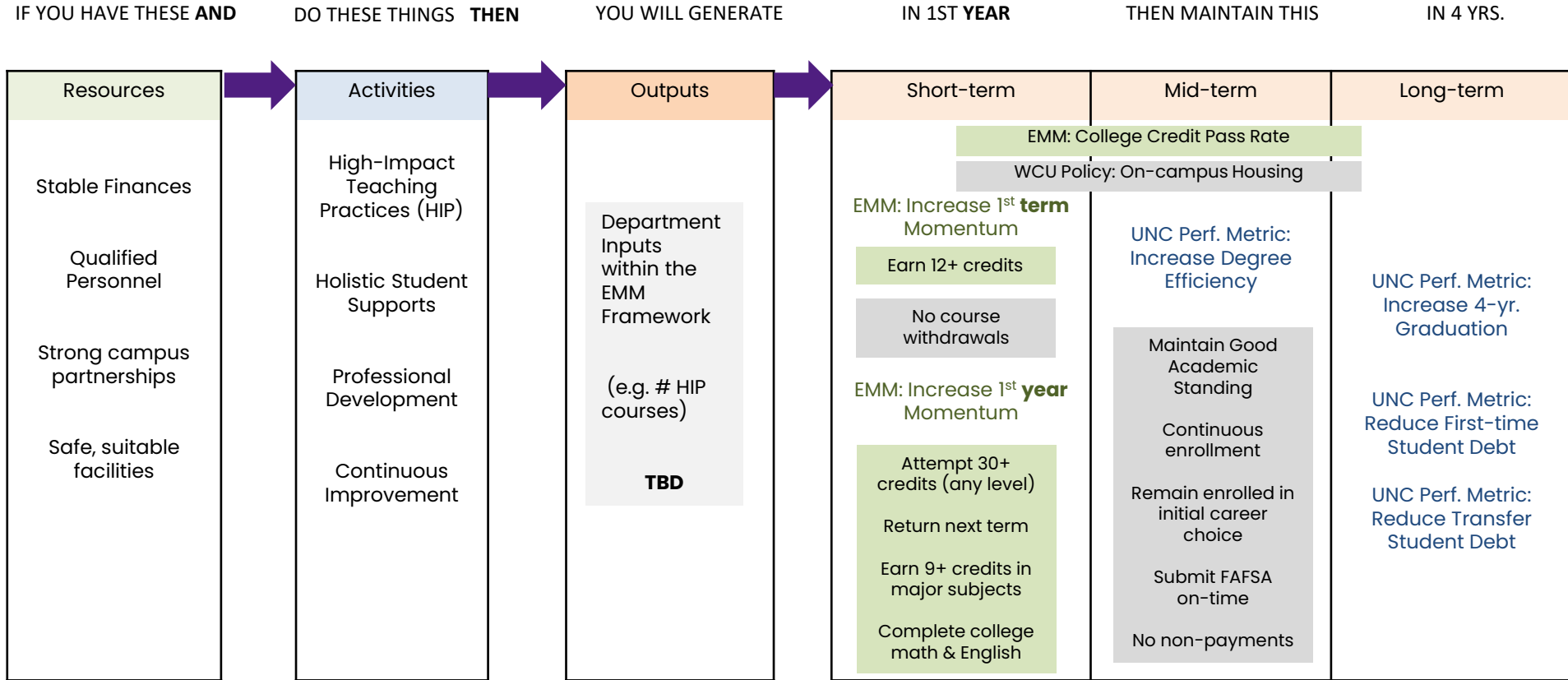
Completed calculus credits in year 1
(Any calculus course)

Completed calculus foundation credits in year 1
(Precalculus/College Algebra)

Completed STE foundation credits in year 1
(Intro to Chem, Bio, Physics)

Completed STE pathway credits in year 1
(Chem, Bio, Physics)

EMM Logic Model – Student Success Framework



EMM Framework Retention Dashboard



Construction Management	Electrical and Computer Engineering Technology	Electrical Engineering (Joint with UNCC)	Engineering	Engineering Technology
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Term Type

Fall

Cohort Type

First-time, Full-time Freshman

Cohort Term

Multiple selections

Cohort Count

413

Characteristics

HS Weighted GPA Level

All

MATH 153 Prior Credit

All

Gender

All

Age Range

All

Race/Ethnicity

All

Transferred Hours Range

All

WCU Admissions Band

All

2nd Term Progression Rate

80.8%

3rd Term Retention Rate

61.9%

First Term Outcomes

CET Withdrawals

All

MATH 153 Outcome

All

Attempted Hours

All

Non-CET Withdrawals

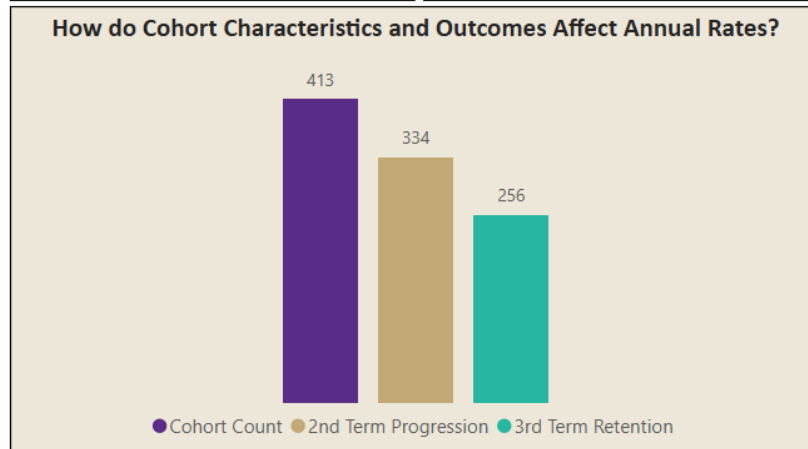
All

Academic Standing

All

Earned Hours

All



Second Term Outcomes

CET Withdrawals

All

MATH 153 Outcome

All

Attempted Hours

All

Non-CET Withdraw...

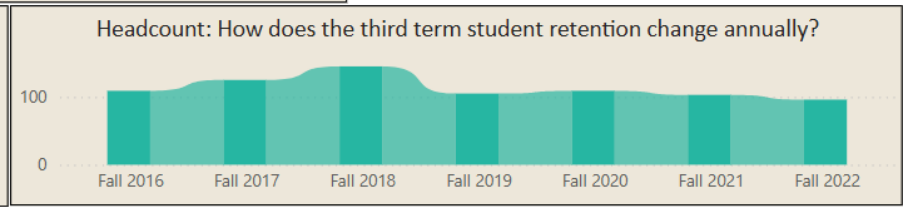
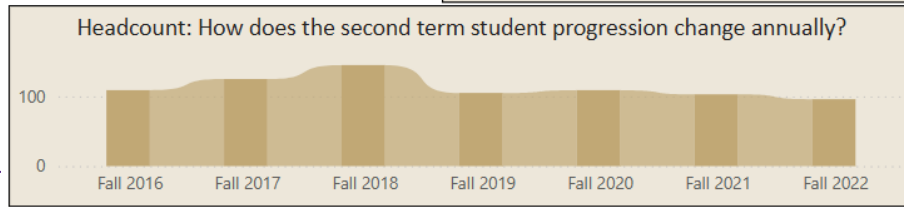
All

Academic Standing

All

Hours Earned

All



EMM Framework Analysis

CET FTFTF Fall 2019–2022 Cohort Retention (n=413)

Term 2: **80.8%**

Term 3: **61.9%**

EMM	Spring Progression	Fall Retention
	Yes	Yes
First Term Calc 1 Success or Prior Credit	92.6% (149)	77.7% (116)
*t1 and t2 Did not attempt Calc 1	68.4% (190)	48.9% (93)

*74 new CET students failed or withdrew from Calc 1

Term Type

Fall

Cohort Type

First-time, Full-time Freshman

Cohort Term

Multiple selections

Cohort Count

413

What factors have the greatest power to affect a new student passing MATH 153?

Key influencers Top segments

What influences Second Term MATH 153 Outcome to be Second Term Did Not At... ?

When...

...the likelihood of Second Term MATH 153 Outcome being Second Term Did Not Attempted increases by

First Term Total Course Successes is 2 - 3

3.11x

Transferred Hours to WCU is 14 or less

3.00x

First Generation Status is Probable

2.83x

First Term Total Course Non-Successes is more than 0

2.40x

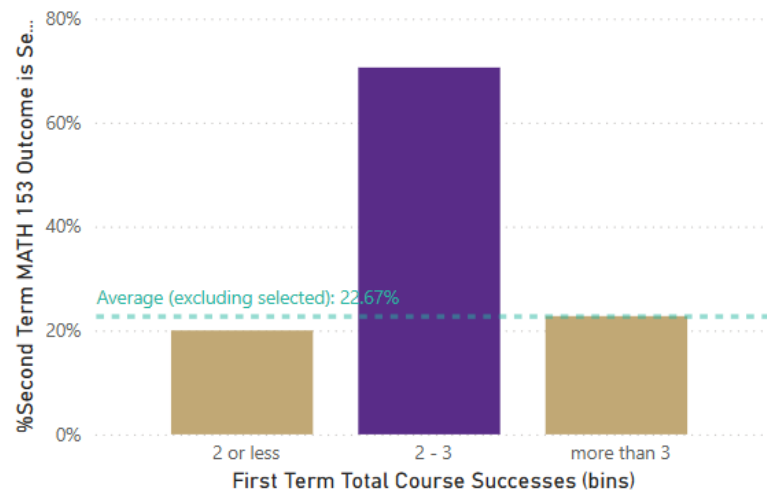
First Term Total CET Course Successes goes down 1.05

2.24x

First Term Academic Standing is

2.16x

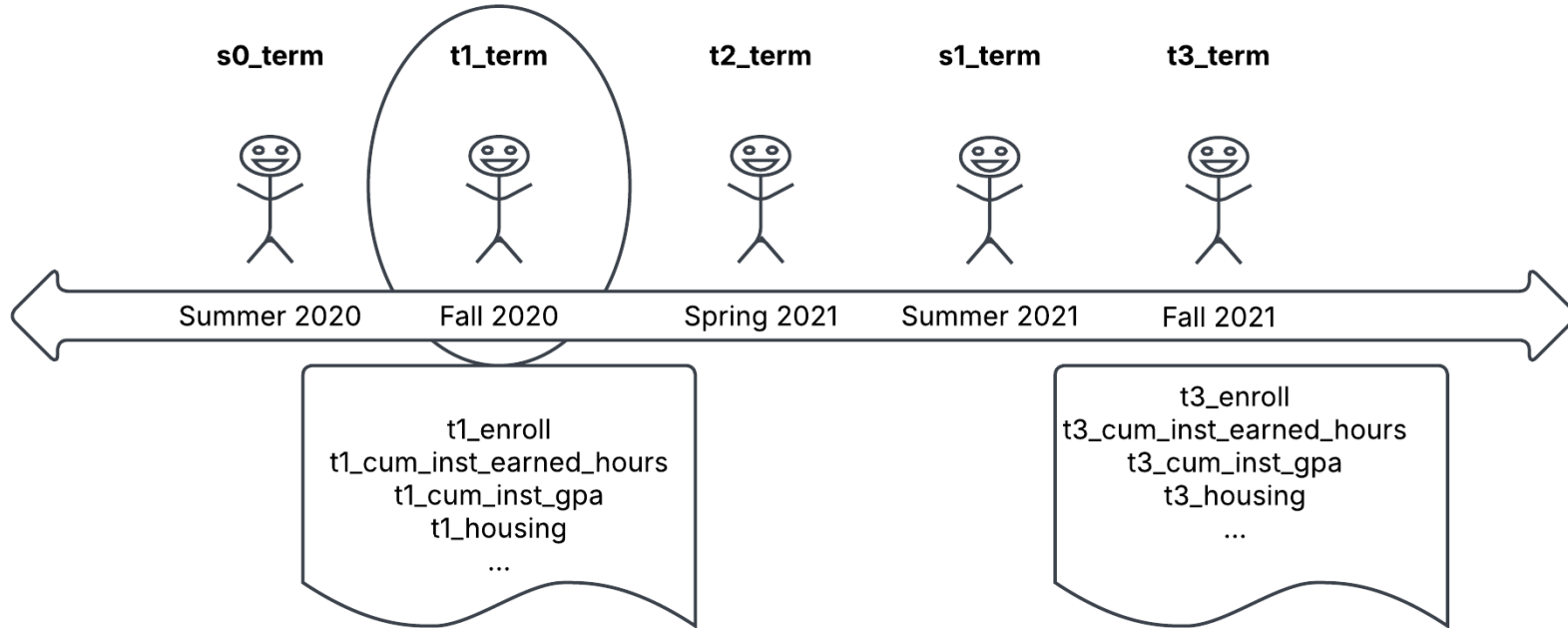
← Second Term MATH 153 Outcome is more likely to be Second Term Did Not Attempted when First Term Total Course Successes is 2 - 3 than otherwise (on average).



Only show values that are influencers



Term Scaffolding



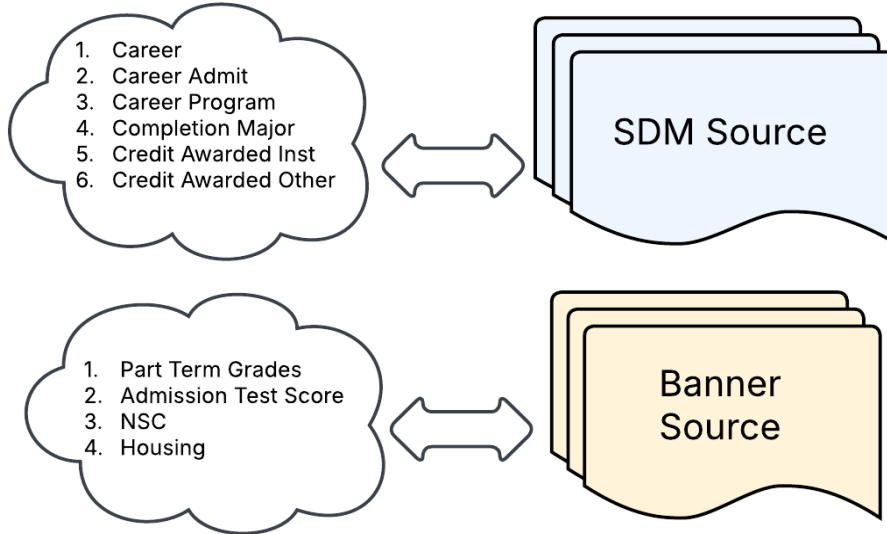
t1_enroll
t1_cum_inst_earned_hours
t1_cum_inst_gpa
t1_housing
...

t3_enroll
t3_cum_inst_earned_hours
t3_cum_inst_gpa
t3_housing
...

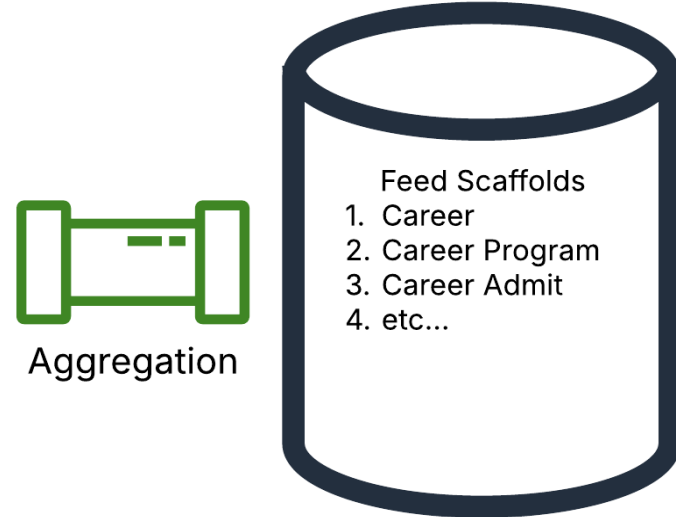
Student	Term_1	Term_2	Term_3	Term_4	Term_i
Nathan	Summer 2020	Fall 2020	Spring 2021	Summer 2021	Term i

Expanding Sources

Varying levels of detail.



Same level of detail.



Career Feed Aggregation

Career Feed

Term	Student	GPA	Credit Earned
1	a	3	15
2	a	3.1	12
3	a	3.2	10
4	a	3.3	10
5	a	3.4	13
1	b	4	8
3	b	3	12
5	b	2	12
1	c	2	12
2	c	3	8
4	c	4	9

Source tables that have a student and term level of detail are straightforward pivot table aggregations.

Aggregate

Career Scaffold

student	t1_enroll	t2_enroll	t3_enroll	t4_enroll	t5_enroll	t1_gpa	t2_gpa	t3_gpa	t4_gpa	t5_gpa	t1_credit_earned	t2_credit_earned	t3_credit_earned	t4_credit_earned	t5_credit_earned
a	1	1	1	1	1	3	3.1	3.2	3.3	3.4	15	12	10	10	13
b	1	0	1	0	1	4		3		2	8		12		12
c	1	1	0	1	0	2	3		4		12	8		9	

Course Feed Aggregation

Course Feed

Term	Student	Course	Grade
1	a	d	A
1	a	e	B
1	a	f	B
2	a	g	B
2	a	h	A
1	b	d	F
1	b	e	C
1	b	f	D
1	b	g	A
2	b	h	A
2	b	i	A

Source tables that have more level of detail than student and term need well defined aggregations.

Aggregate

Course Scaffold

Evidence based variable inclusion.

student	t1_pass_course	t1_fail_course	t2_pass_course	t2_fail_course	t1_d_pass	t1_d_fail
a	3	0	2	0	1	0
b	2	2	2	0	0	1

Simple Joins

```
SELECT [career].[student_cid]
, [career].[t1_term_type]
, [career].[t1_enrollment_status]
, [career].[t1_enrollment_status_ipeds]
, [career].[t1_student_cohort]
, [career].[t1_term]
, [career].[t2_term]
, [career].[t3_term]
, [career].[t4_term]
, [career].[t5_term]
, [career].[t8_term]
, [career].[t12_term]
, [career].[t1_enroll]
, [career].[t2_enroll]
, [career].[s1_enroll]
, [career].[t3_enroll]
, [career].[t4_enroll]
, [career].[t5_enroll]
, [completion_major].[t5_grad_by]
, [completion_major].[t8_grad_by]
, [completion_major].[t12_grad_by]
, [enrolled_student_detailed].[t1_RMS_Housing_Indicator]
, [enrolled_student_detailed].[t2_RMS_Housing_Indicator]
, [enrolled_student_detailed].[t3_RMS_Housing_Indicator]
, [enrolled_student_detailed].[t4_RMS_Housing_Indicator]
, [enrolled_student_detailed].[t5_RMS_Housing_Indicator]
, [career].[t4_cum_inst_earned_hours]
, [career].[t4_cum_inst_gpa]
, [career].[t5_cum_inst_earned_hours]
, [career].[t5_cum_inst_gpa]

FROM [Test_OIPE].[scaffold].[career]
LEFT JOIN [Test_OIPE].[scaffold].[enrolled_student_detailed] ON [career].[student_cid] = [enrolled_student_detailed].[student_cid]
LEFT JOIN [Test_OIPE].[scaffold].[completion_major] ON [career].[student_cid] = [completion_major].[student_cid]
WHERE
    [career].[t1_student_cohort] = 'FTFTF'
AND [career].[t1_term] = '202080'
--AND [career].[t1_term] = '202180' --Housing policy for freshman change. Fall 202180 freshman are required to live on campus for two academic years
```

Population Assignments

```
A = df[
    (df['t1_RMS_Housing_Indicator'] == 1)
    & (df['t2_RMS_Housing_Indicator'] == 1)
    & (df['t3_RMS_Housing_Indicator'] == 1)
    & (df['t4_RMS_Housing_Indicator'] == 1)

    & (df['t1_enroll'] == 1)
    & (df['t2_enroll'] == 1)

    & (df['s1_enroll'] == 0)

    & (df['t3_enroll'] == 1)
    & (df['t4_enroll'] == 1)
]
```

Group A: On Campus Housing first two academic years.

```
B = df[
    (df['t1_RMS_Housing_Indicator'] == 1)
    & (df['t2_RMS_Housing_Indicator'] == 1)
    & (df['t3_RMS_Housing_Indicator'] == 0)
    & (df['t4_RMS_Housing_Indicator'] == 0)

    & (df['t1_enroll'] == 1)
    & (df['t2_enroll'] == 1)

    & (df['s1_enroll'] == 0)

    & (df['t3_enroll'] == 1)
    & (df['t4_enroll'] == 1)
]
```

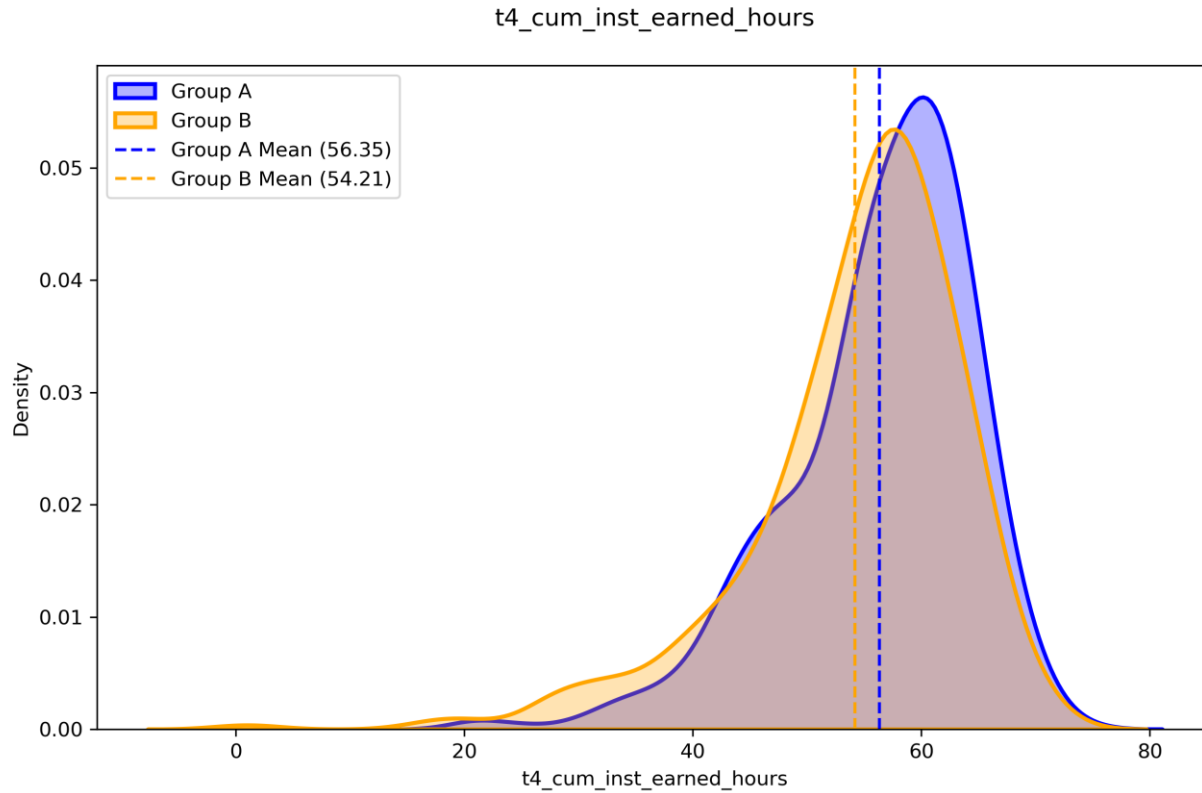
Group B: On Campus Housing first academic year only.

*Both populations have similar enrollment pattern.

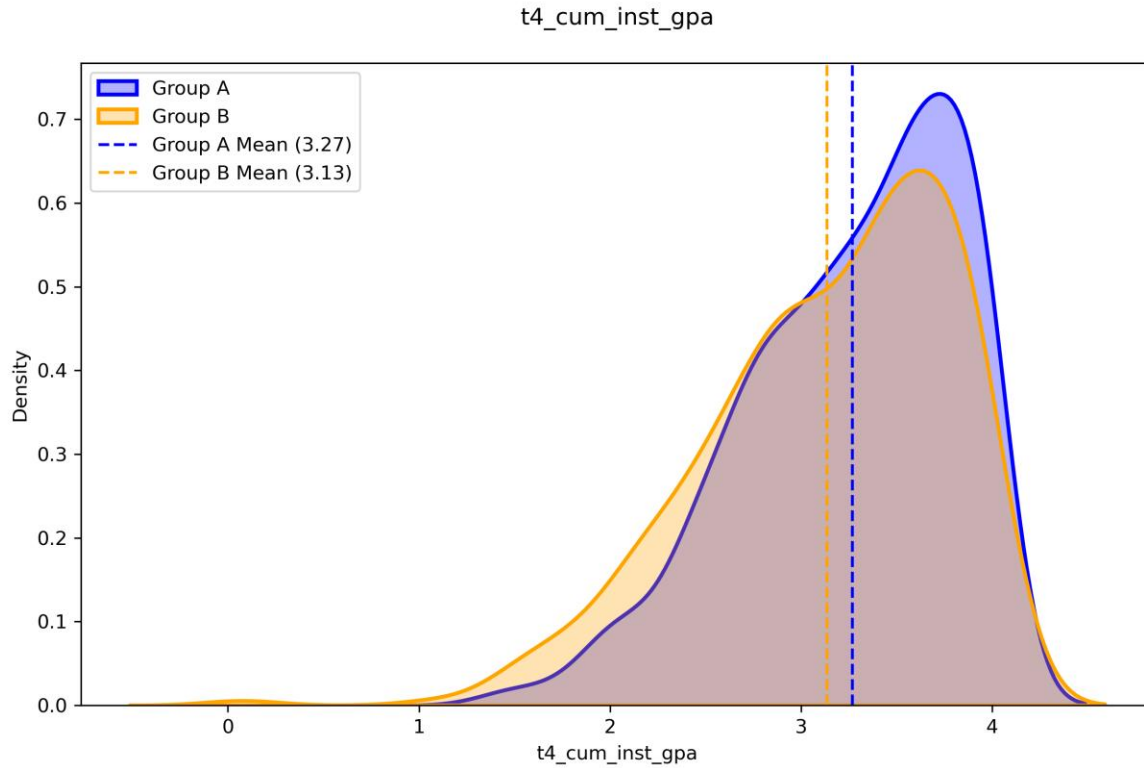
```
print('There are',len(A),'students from the original cohort in population A.')
print('There are',len(B),'students from the original cohort in population B.')
```

There are 492 students from the original cohort in population A.
There are 375 students from the original cohort in population B.

Cumulative Earned Hours , Fourth Term



Cumulative GPA, Fourth Term



Summary

- 1. Machine Learning Ready Dataset**
- 2. Scalable/Modular Design**
- 3. Common language for sharing results**



Western
Carolina
UNIVERSITY

Common Language

Column Name	Data Type	Description
t_i_term	String	The i^{th} Fall/Spring term. For example, t_1_term is the first Fall/Spring term that the student was enrolled, t_2_term is the next Fall/Spring term, and so on.
s_i_term	String	The i^{th} summer term. For example, s_0_term is the summer directly preceding the first Fall/Spring enrolled term, i.e. t_1_term . s_1_term is the summer succeeding t_1_term .
$t_i_RMS_Housing_Indicator$	Integer	1 if the student is housed on campus and 0 if the student is not housed on campus in the i^{th} term.
$t_i_cum_inst_earned_hours$	Float	The cumulate earned hours at the institution in term t_i_term .
$t_i_cum_inst_gpa$	Float	The cumulate earned gpa at the institution in term t_i_term .