



EDUM: Classroom Education Measurements via Large-scale WiFi Networks

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Traditional Ways to access Classroom Teaching



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评估问卷填写

效果评价系统使用说明：

在“教学评估”系统界面中，点击左侧“评估问卷填写”菜单，右侧会出现评估问卷填写的界面。

一、教师评价

在“教师评价”界面，您需要完成对所选课程的多位任课教师的评价和课程的整体评价。

您需要对7项指标打分来对每位教师进行评价，同一门课课程的多位教师前6个指标相同，第7个指标有可能不相同。对符合指标的描述，7分为最高分，表示完全符合指标的描述。除对每项指标打分外，您还可以点击“填写”按钮，对教师的评价进行任课教师后，您可以对课程进行整体评价。您需要对一项指标进行打分并对课程提出具体建议，和教师评价一样，评价完成后请勿忘记点击底部的“提交”按钮以完成评价。

二、助教评价

在“助教评价”界面，您需要完成对课程助教的评价。

不是每门课程都有助教，如果有助教，您需要对2项指标打分来对每位助教进行评价，和教师评价一样，1分为最低分，建议：

评价完成后请勿忘记点击底部的“提交”按钮以完成评价。

提醒：

所有评估数据最终都是匿名的，请同学们填写时不要有顾虑。

请严格遵守《高等学校校园网安全管理条例》，严禁使用侮辱性语言和进行人身攻击，违者后果自负。

请按照实际情况打分，如果平均分过高或过低，系统会给您提示请您认真思考。

评估过程中有任何问题，请拨打咨询电话：62773921、62773918

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课程名

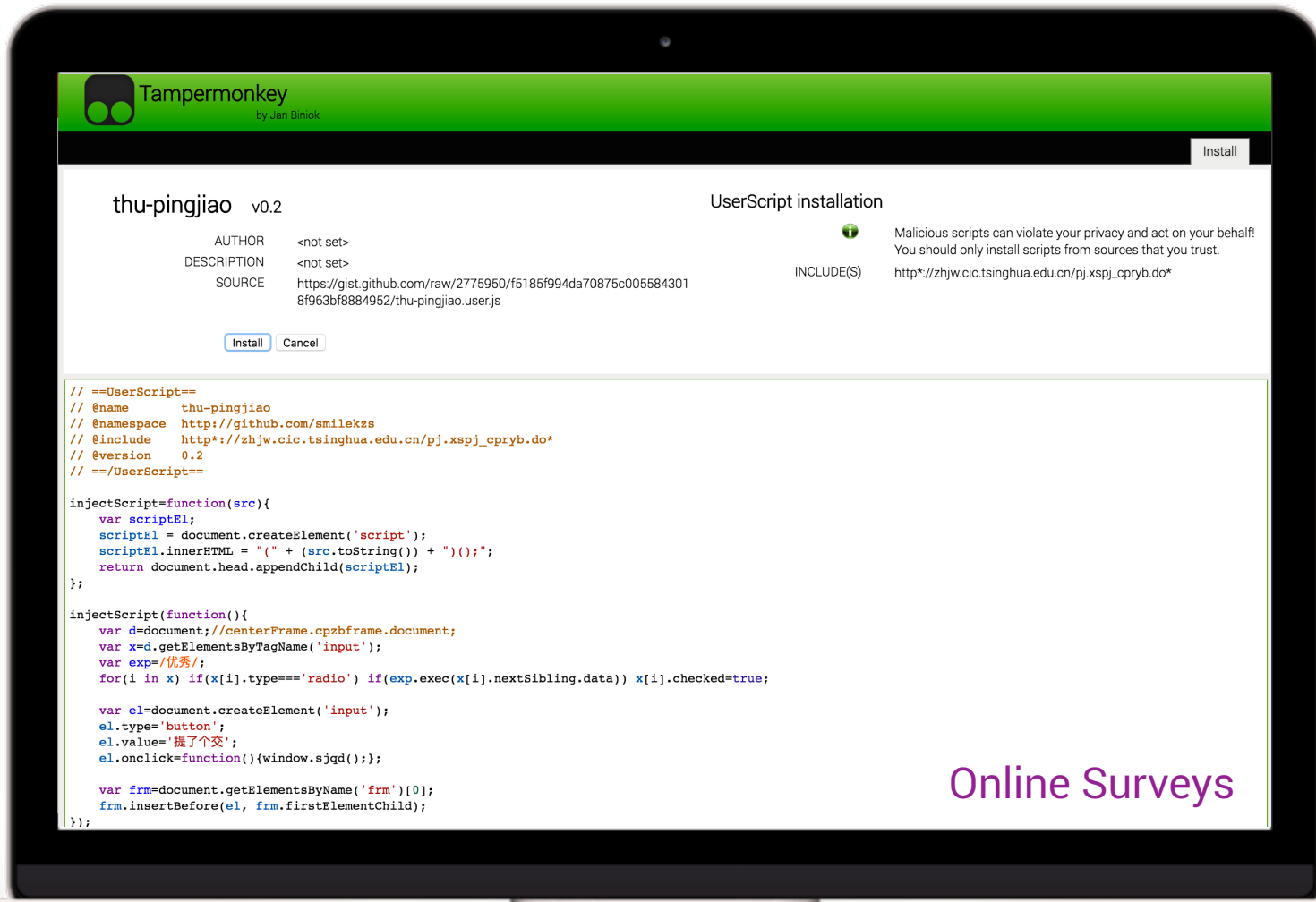
⌵ 暂停

教师	课程目标清晰度	教师帮助度	学生认可度	教学方案有效性	教师水平	关注学科前沿	其他	对教师的建议	
教师姓名	选择分： <div>▼</div>	选择分： <div>▼</div> <div>选择分数</div> <div>1</div> <div>2</div> <div>3</div> <div>4</div> <div>5</div> <div>6</div> <div>7</div>	选择分： <div>▼</div>	选择分： <div>▼</div>	选择分： <div>▼</div>	选择分： <div>▼</div>	选择分： <div>▼</div>	教师水平 选择分： <div>▼</div>	请填写对本教师的建议，小于200字，超过部分系统 will 自动截取
<div style="display: flex; justify-content: space-between;"> <div> 本课程综合评价 学生收获度 选择分数 <div>▼</div> </div> </div>									

Online Surveys

Traditional Ways

to access Classroom Teaching



Traditional Ways

to access Classroom Teaching

Online Surveys

Time-consuming
High costs

Manual Checkins

Subjective
Biases
Obscure scales
Qualitative

Small Experiments

Self Reports

Intrusive
Low diversity
Low coverage

Peer Reviews

Cheat-prone
Ex post



Traditional Ways

to access Classroom Teaching

Low-quality data collected via **costly** process.



Motivation

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MOOC

Large-scale measurements of fine-grained web user behaviors!



Classroom

Large-scale in-situ measurements of accurate behavior?

Large-scale In-situ

Classroom Education Measurements



Basic Ideas

Approximate Mobility



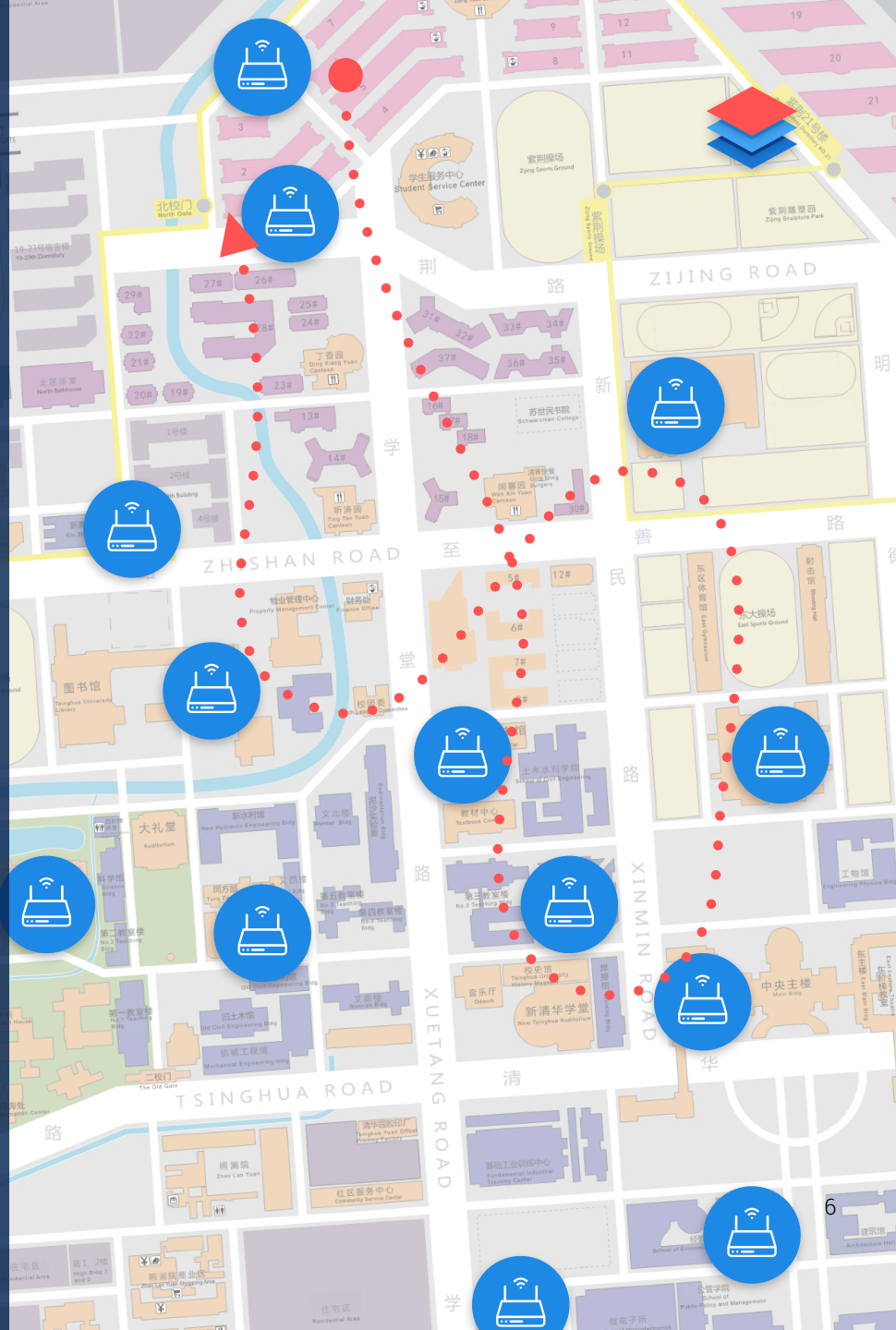
Carry-on Mobile Devices
with apps & wireless chips



Ubiquitous WLAN
densely deployed on campuses



Mobility
of the devices tracked by WLAN



Punctuality & Attractiveness

INTRODUCTION

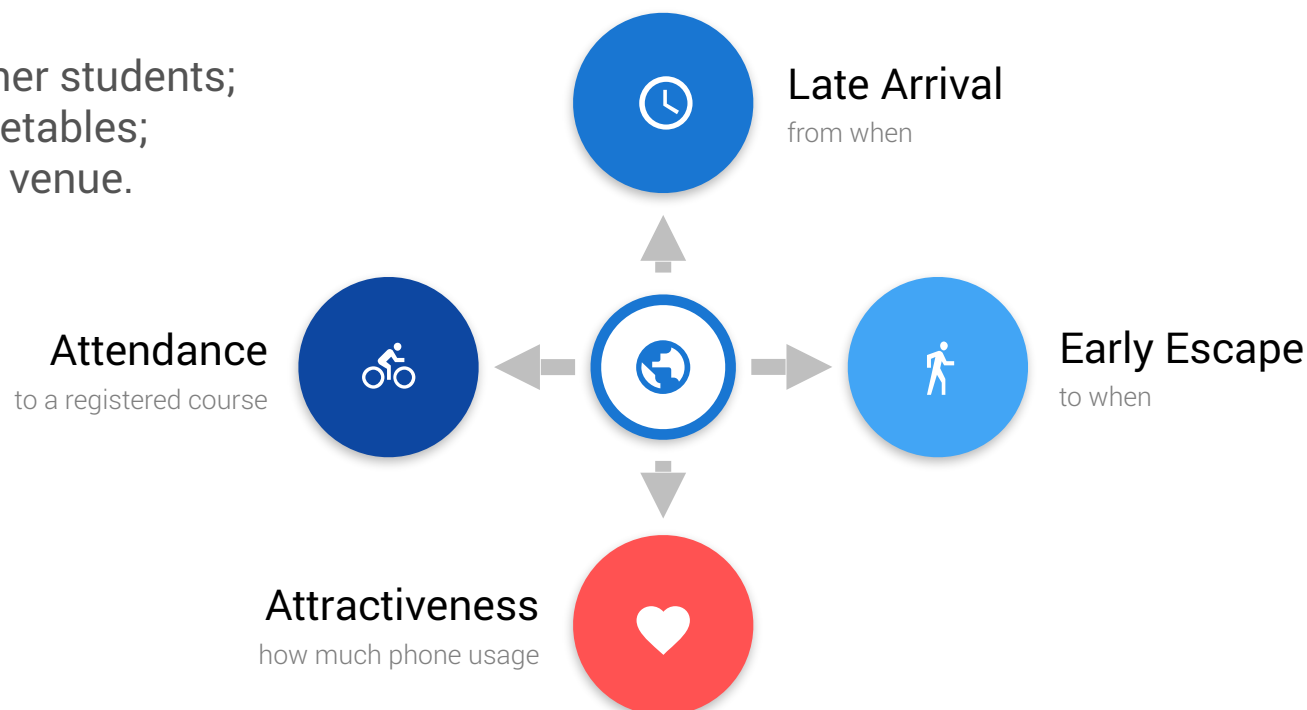
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- Mobility;
- + Device owner students;
- + Course timetables;
- + Classroom venue.



Challenges

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Challenge 1

- Registered courses
- Phone usages
- ...

Educational ground truths
are fundamentally hard to
collect.

- Not public available
- Privacy concerns
- ...

Challenges

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Challenge 2

Using WiFi data to
determine course's venue
and whether a student is
in the classroom.

Classroom \longleftrightarrow WiFi
× Localization services



EDUM

EDUM

Education **M**easurement System
@Tsinghua

~4.4km² campus

~57,000 population



>2,700 APs



>60,000 per day



classroom level

* All statistics are by Jan 2016.

Crowd-sourcing Apps

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TUNet
Campus Network Tool



Automatically
Login, protect & manage account



Phone interactive states
with account & MAC mapping



15,000+ users
Both Android and iOS



Tsinghua Now
Campus Life Helper

Prioritized
Information card flow

Registered courses
with account & MAC mapping

1,200+ users
~700 volunteers



Data Processing

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Challenge 1

Educational ground truths
are fundamentally hard to
collect.

Challenge 2

Using WiFi data to
determine course's venue
and whether a student is in
the classroom.



Data Processing

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Challenge 1

- Student's devices
- Their registered courses
- How much phone usage

Challenge 2

Using WiFi data to determine course's venue and whether a student is in the classroom.



Data Processing

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Challenge 1

- Student's devices
- Their registered courses
- How much phone usage

Challenge 2

- Classroom venue (WiFi)
- Accurate ending time
- Students' attendance



Large-scale Measurements

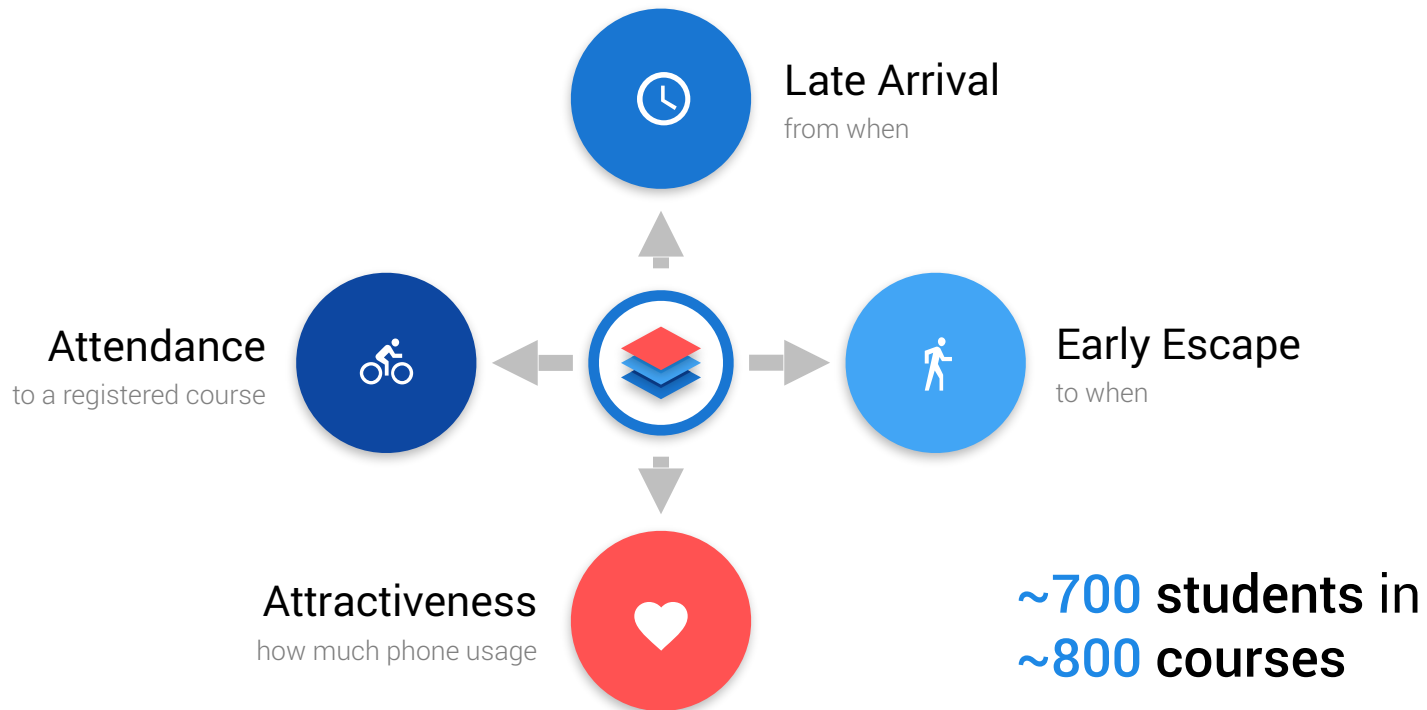
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The background features a series of overlapping chevron shapes pointing to the right. The colors are various shades of blue, with a prominent dark blue chevron in the center and a bright red chevron layered on top of it. The text is positioned on the left side of the image.

Punctuality

Attendance, late arrival, early escape

Attendance Ratios (for Courses)

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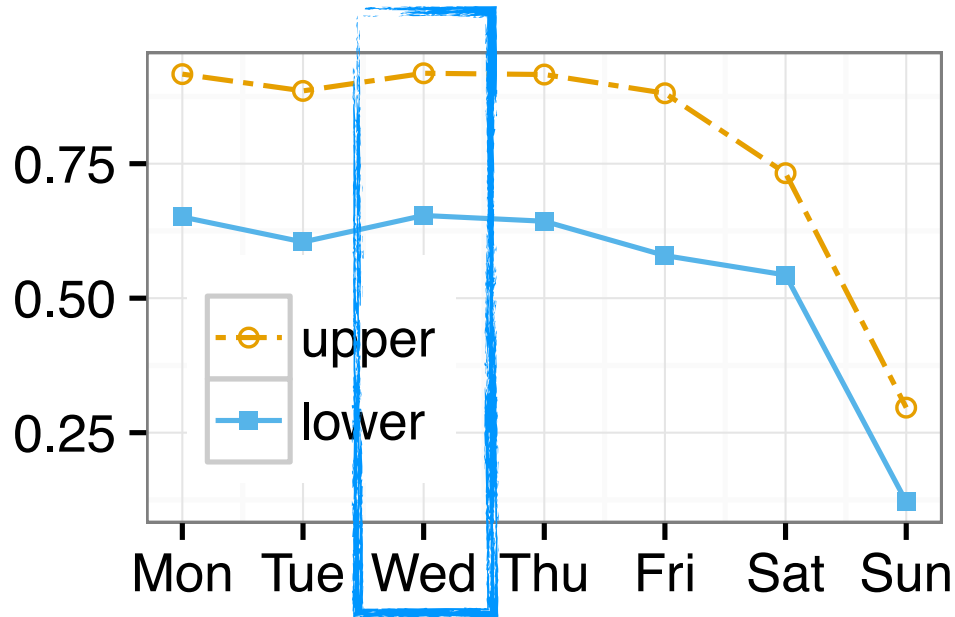
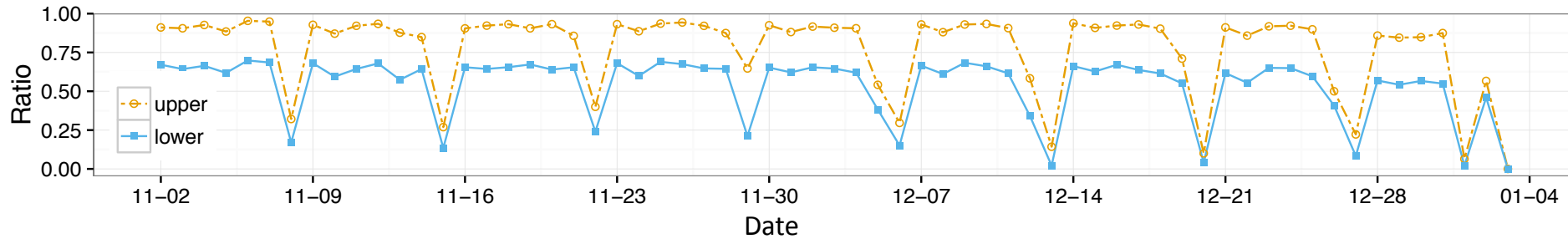
Lecture Attendance Ratio:

$$\frac{\#(\text{attended students})}{\#(\text{appeared students on campus})}. \quad (1)$$

“appeared on campus”:

- **upper** bound: during the **lecture** (smaller #students)
- **lower** bound: during the **day** (larger #students)

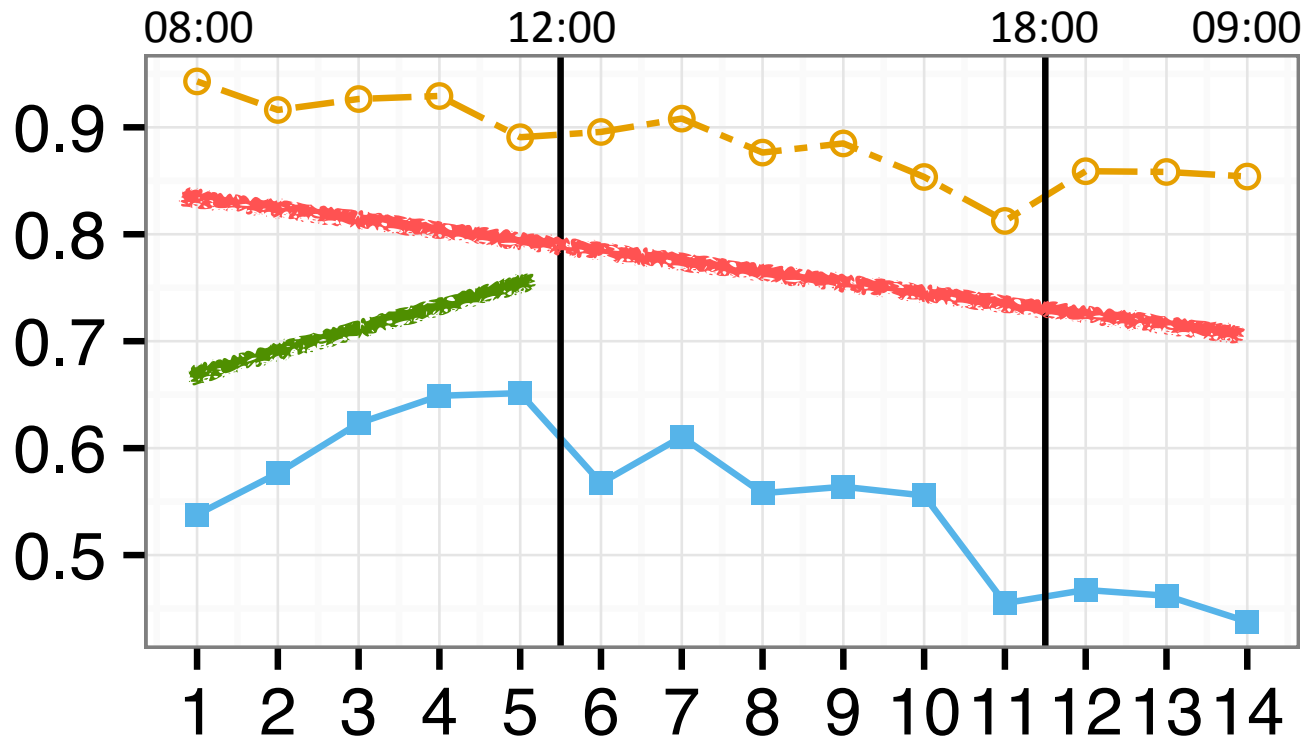
Temporal Patterns of Attendance Ratios



- Wednesday is the most hard-working day.

Temporal Patterns of Attendance Ratios

14 timeslots per day. Each timeslot is 45-min long.



- Attendance ratio **decreases** from morning to afternoon to evening.
- “Stay-in-bed” effect.

Late Arrival & Early Escape Ratios (for Courses)

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$$\text{late ratio} = \frac{\#(\text{late arrived students})}{\#(\text{attended students})} \quad (3)$$

$$\text{escape ratio} = \frac{\#(\text{early escaped students})}{\#(\text{attended students})}. \quad (4)$$

Punctuality Metrics for Students

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Student **Attendance** Ratio:

$$\frac{\#(\text{lectures attended})}{\#(\text{lectures that s/he appeared on campus})}$$

Student **Late** Arrival Ratio:

$$\frac{\#(\text{lectures that arrived lately})}{\#(\text{lectures attended})}$$

Student Early Escape Ratio:

$$\frac{\#(\text{lectures that departed early})}{\#(\text{lectures attended})}$$

Punctuality Metrics for Students

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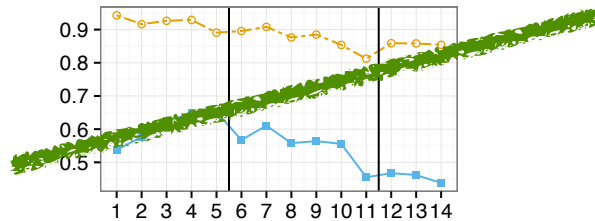
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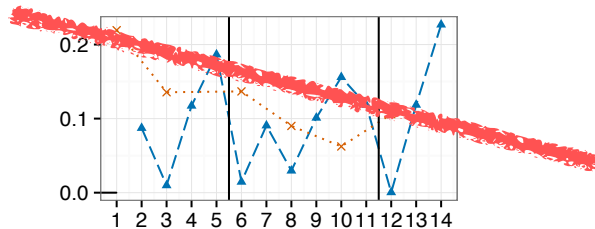
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Student Attendance Ratio:



Student Late Arrival Ratio:



Night Owls:
Increasing attendance &
Decreasing late arrival
over the day



Student Attributes v.s. Punctuality

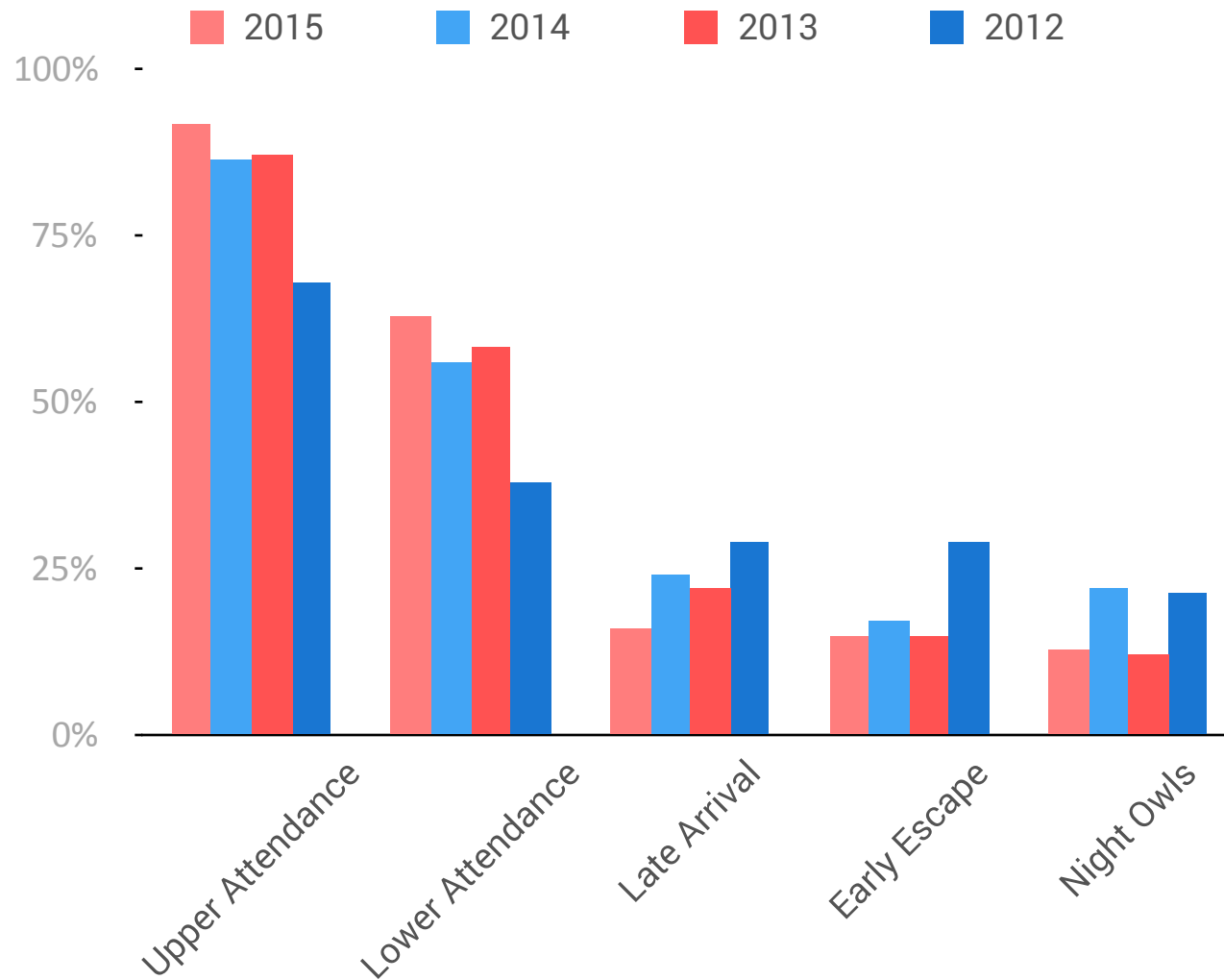
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Student Attributes v.s. Punctuality

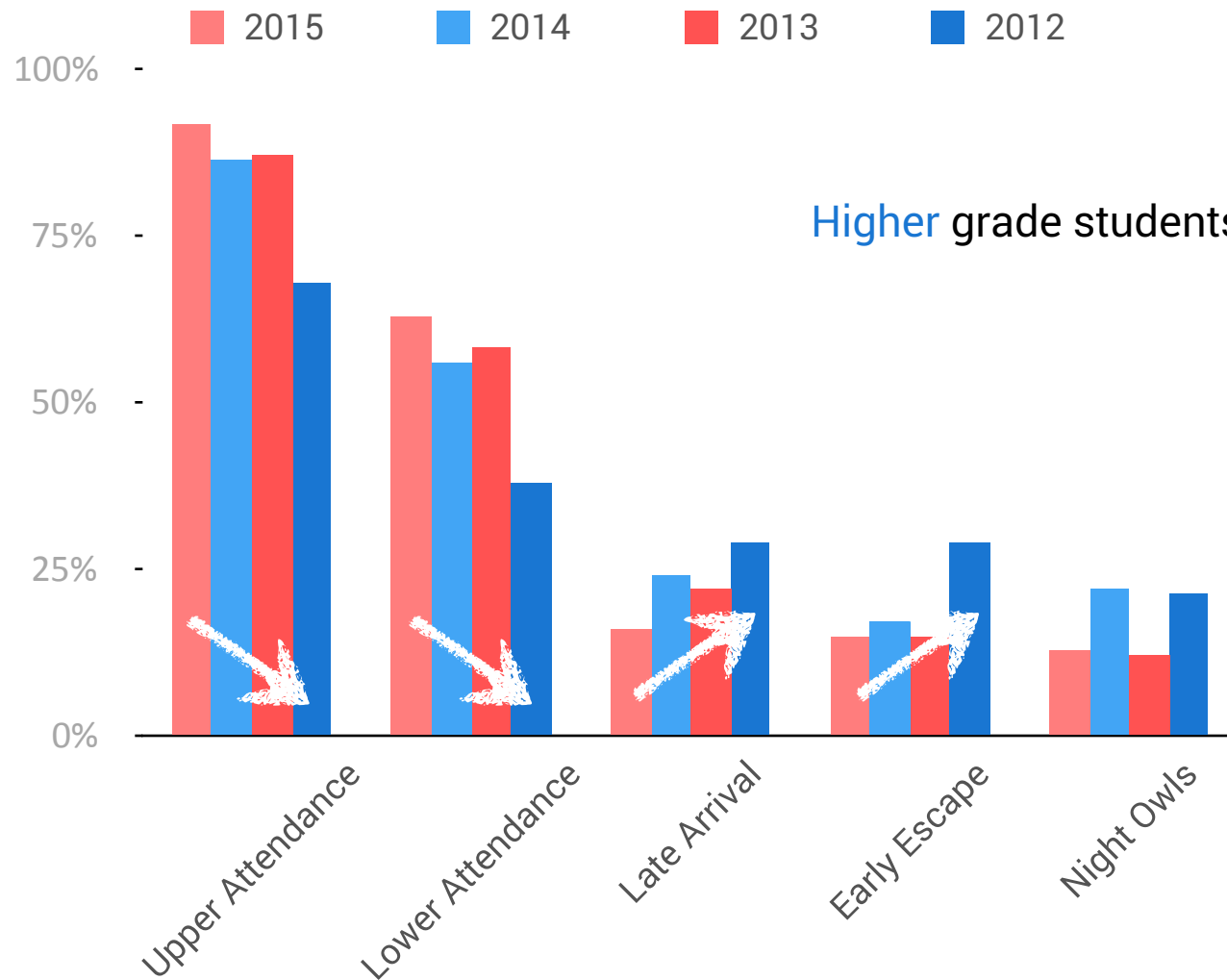
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Student Attributes v.s. Punctuality

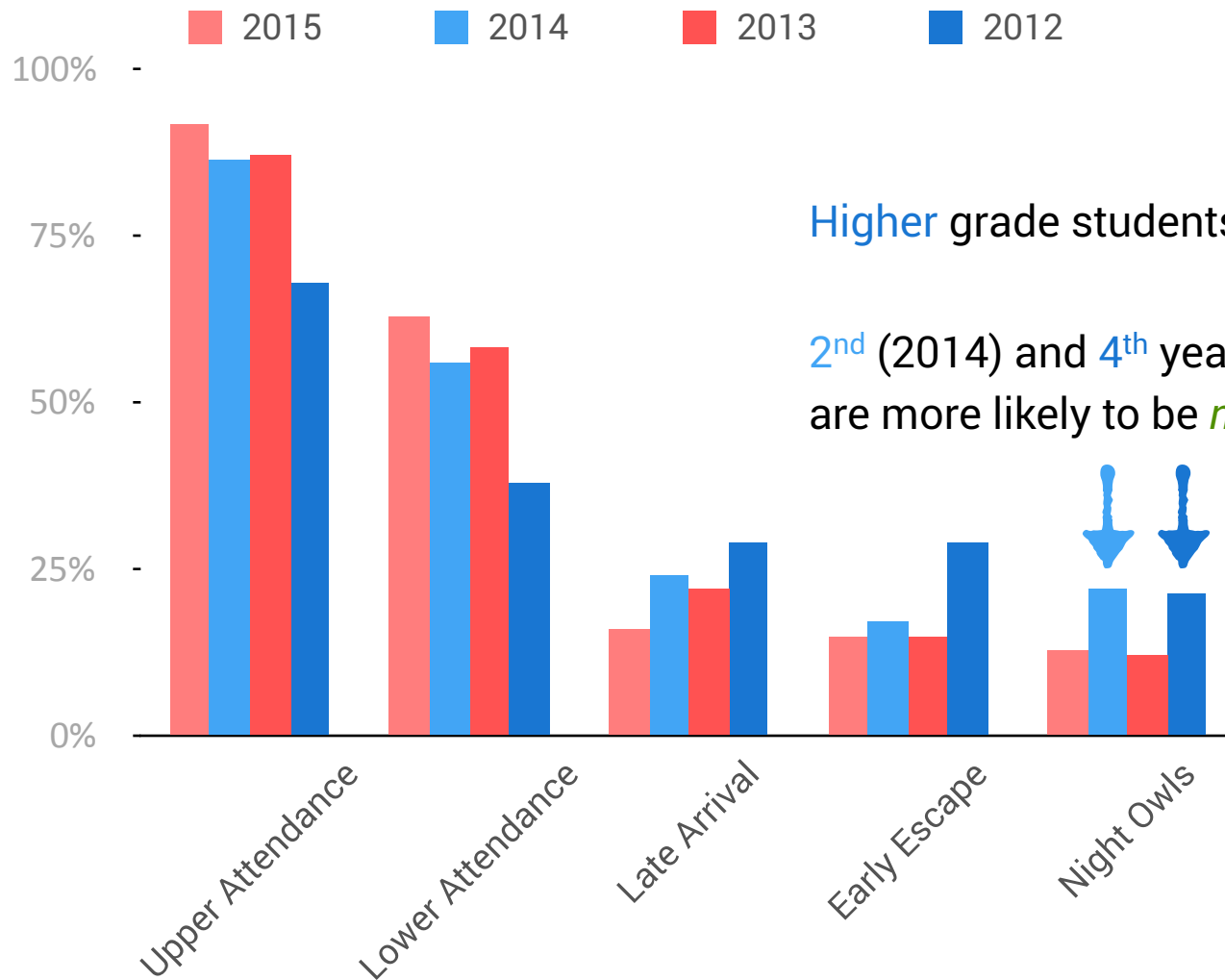
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Higher grade students are *less punctual*.

2nd (2014) and 4th year (2012) students are more likely to be *night owls*.

Punctuality v.s. Study Performance

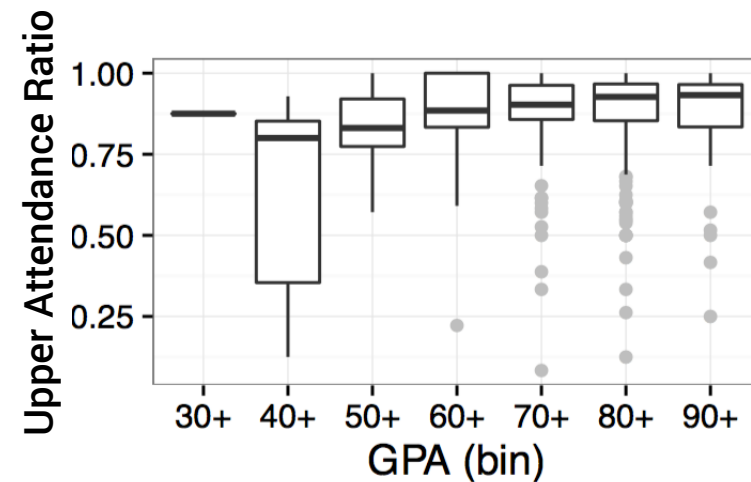
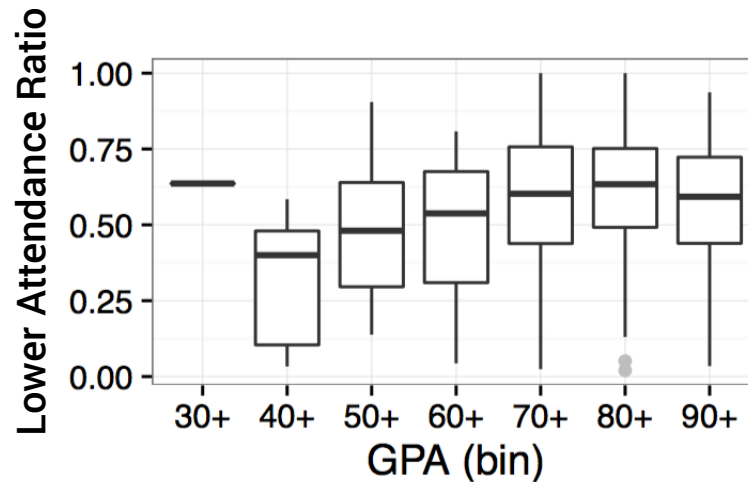
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Students with **higher GPA** attend lectures **more**.

Punctuality v.s. Study Performance

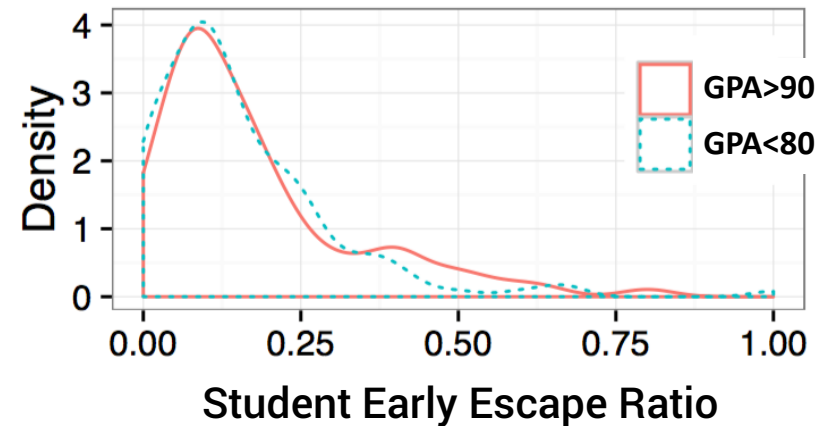
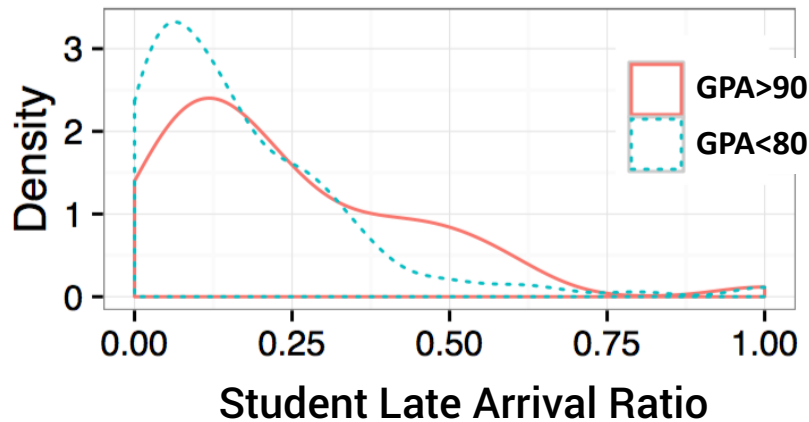
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Students with **higher GPA** attend lectures **more**.

High-performance students are more likely to be **late** than low-performance students.

The background features a series of overlapping, chevron-like shapes pointing towards the right. The colors are various shades of blue, ranging from a deep navy to a light sky blue. A prominent red line runs diagonally across the center, following the path of the chevrons.

Attractiveness

Phone distractions

Interactive Distraction Ratio

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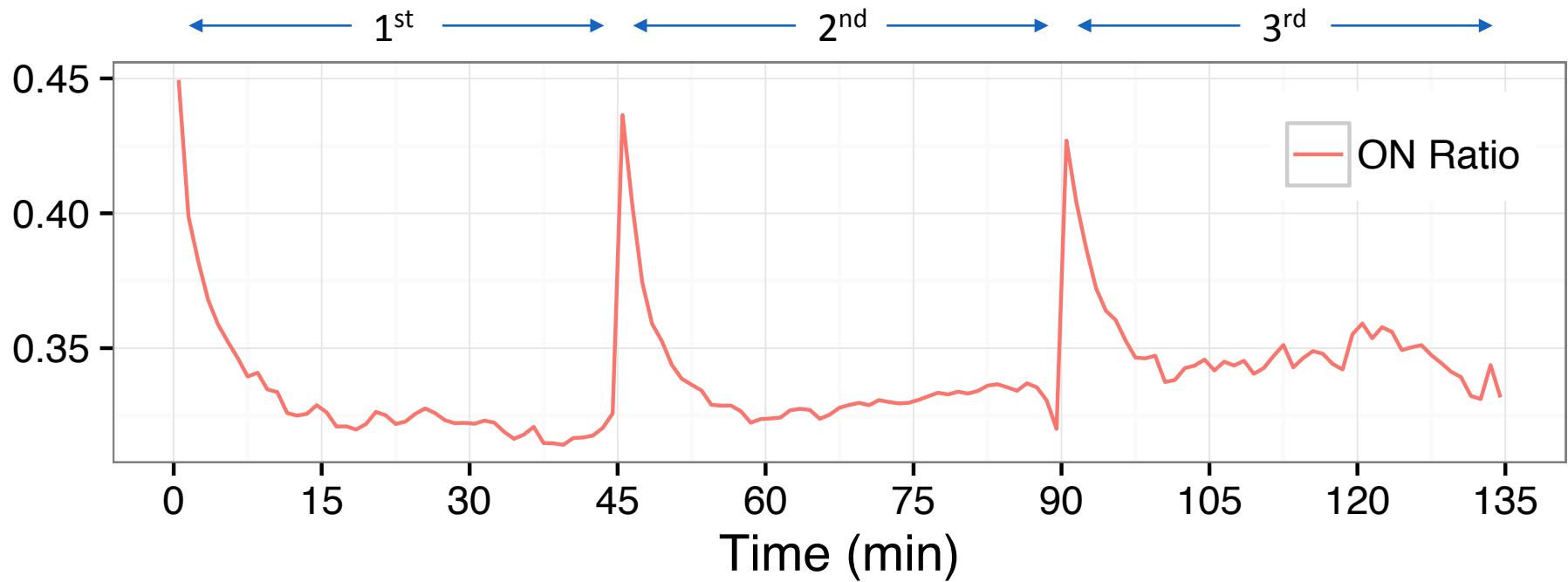
$$\frac{\text{Total ON duration}}{\text{Total ON duration} + \text{Total OFF duration}} \quad (7)$$



Phone interactive states.

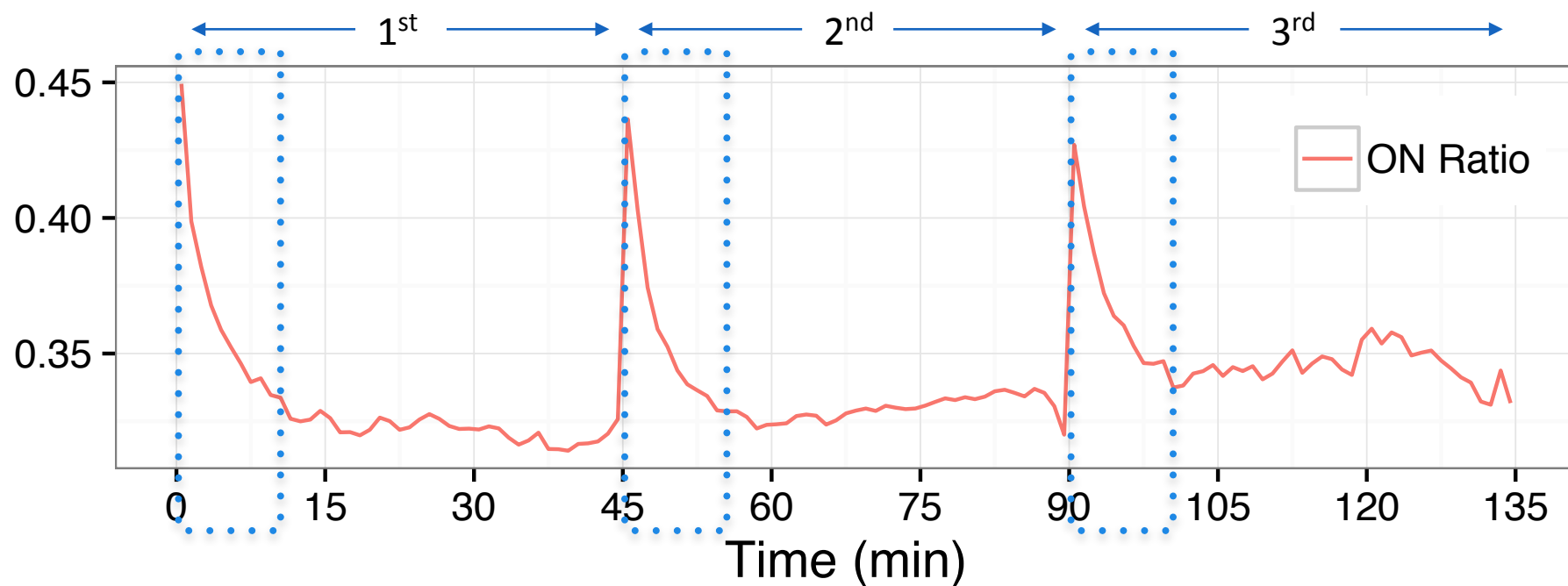
Aggregated Distraction (ON) Ratio

Each timeslot is 45-min long. Break time is cut off.



Aggregated Distraction (ON) Ratio

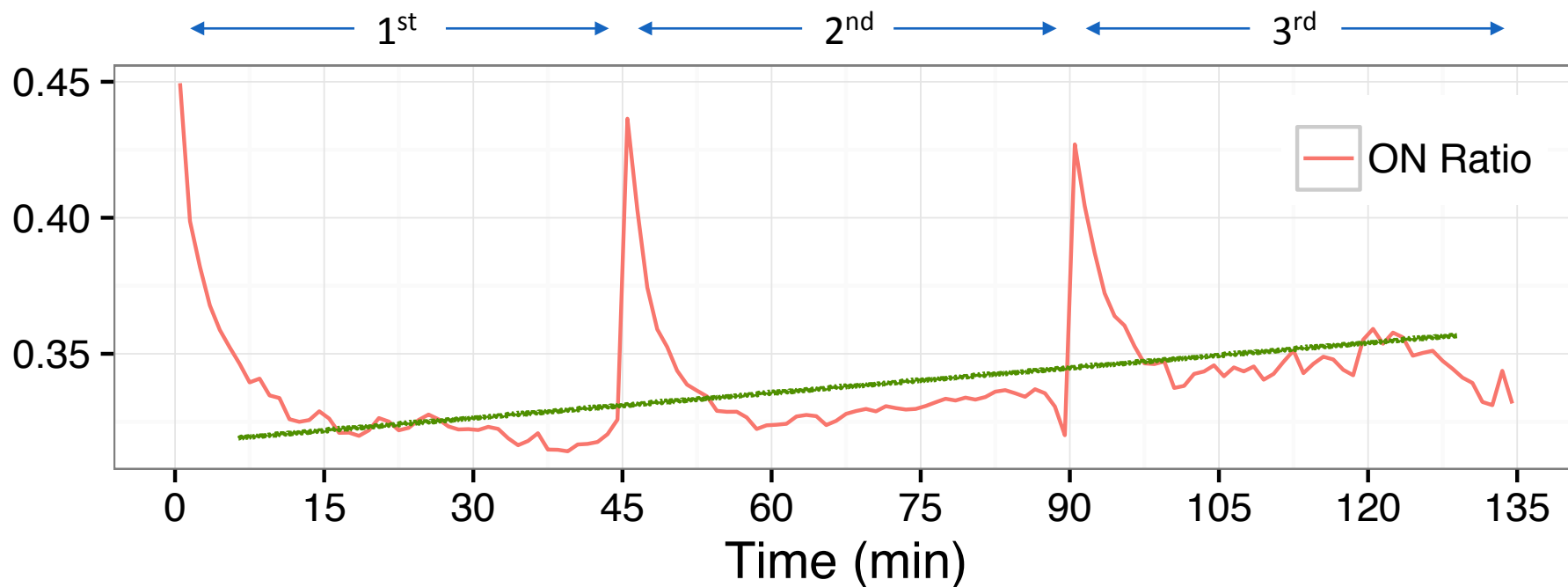
Each timeslot is 45-min long. Break time is cut off.



High phone usage quickly **drops** at the **start** of each timeslot.

Aggregated Distraction (ON) Ratio

Each timeslot is 45-min long. Break time is cut off.

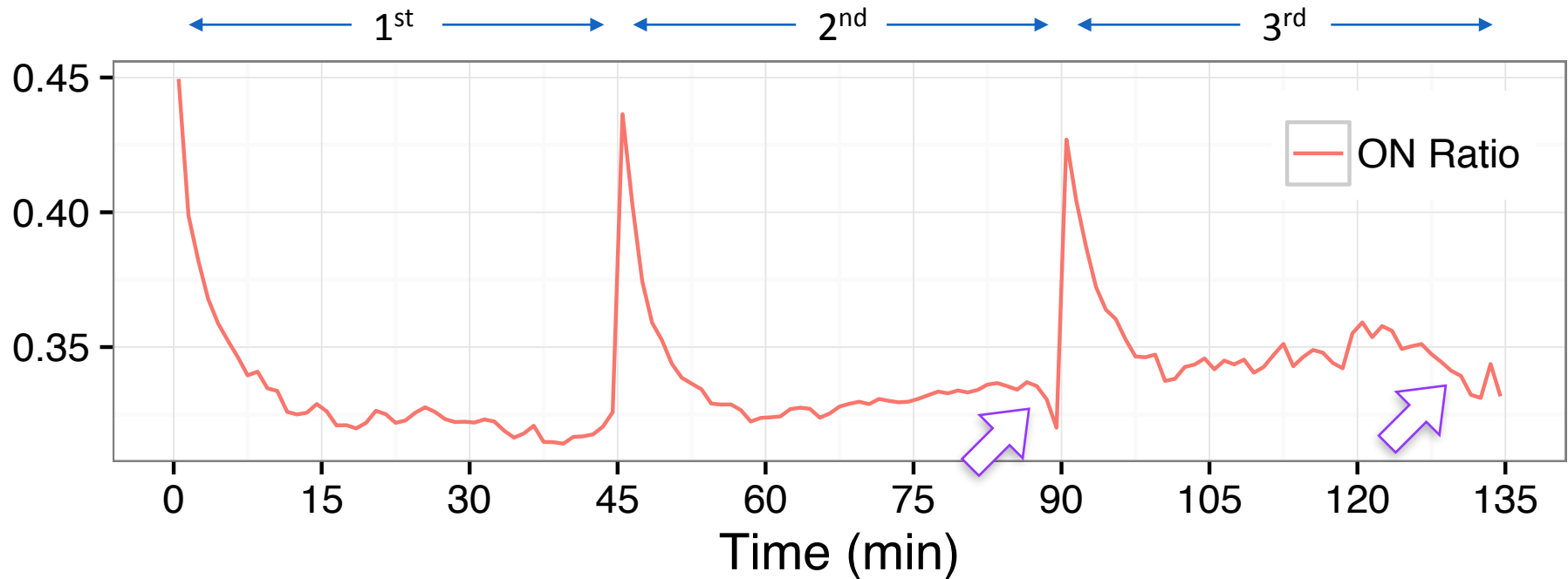


High phone usage quickly **drops** at the **start** of each timeslot.

Students gradually **lose attention** as lecture progresses.

Aggregated Distraction (ON) Ratio

Each timeslot is 45-min long. Break time is cut off.



High phone usage quickly **drops** at the **start** of each timeslot.

Students gradually **lose attention** as lecture progresses.

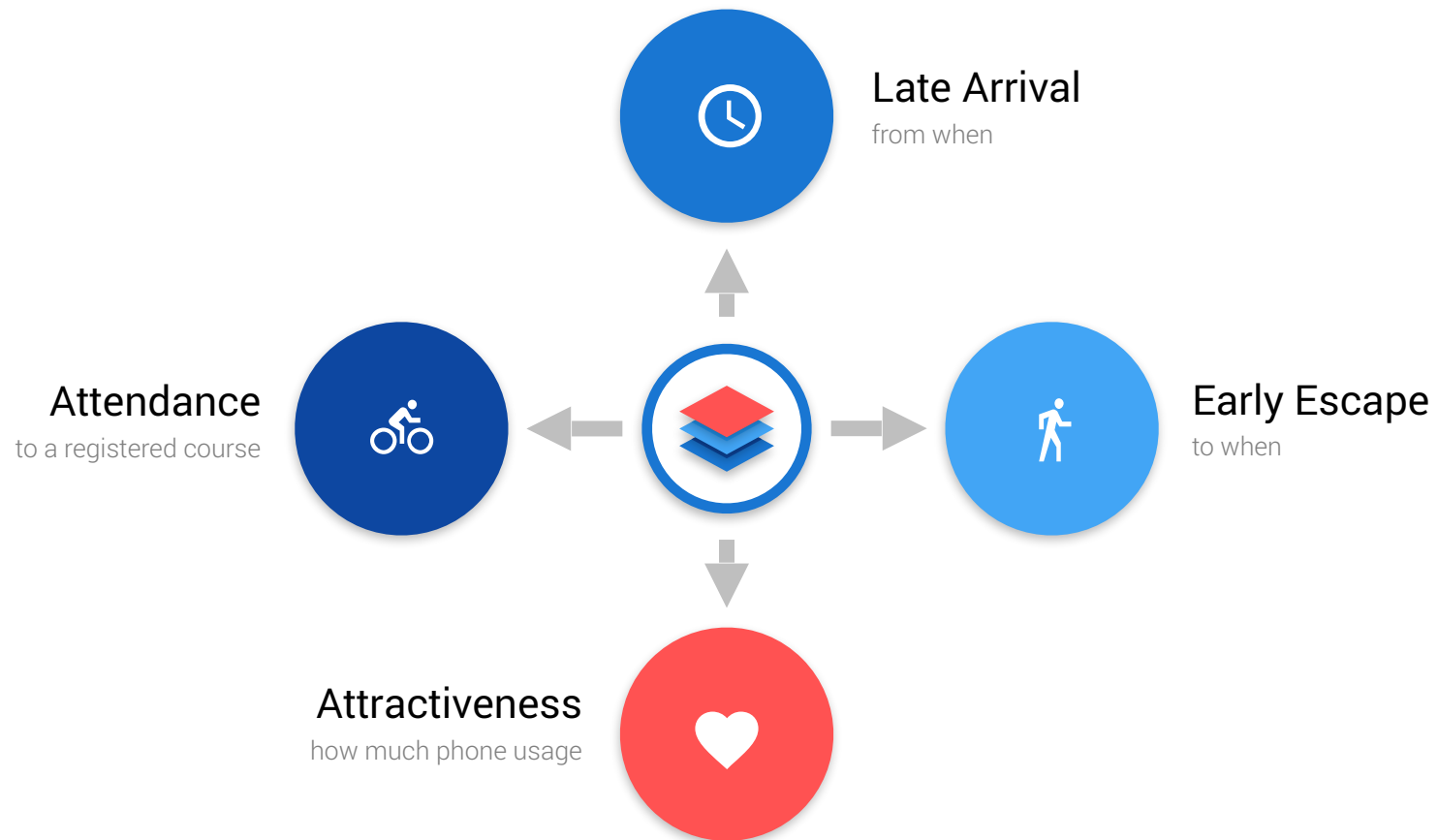
Students **stop** using phones at the **end** of lectures.

Recap: Educational Behaviors



1. **Attendance** and **late arrival** ratios to courses both show that **Wednesday is the most hard-working day**.
2. Class **attendance** is at its **highest in the morning**, and **gradually drops** as the day progresses. Meanwhile, **fewer students arrive late** to classes as the day progresses.
3. Higher grade students are less punctual. The ratio of “night owls” in the 2nd and 4th year is higher than that of the 1st and 3rd year students.
4. Students with higher GPA attend class more. However, they are also more likely to be late compared to low-performance students.
5. Students are more easily distracted as the day progresses.
6. Device usage is highest at the beginning of a lecture, then drops, and then slowly increases as the lecture progresses.
-

Recap: Measurements



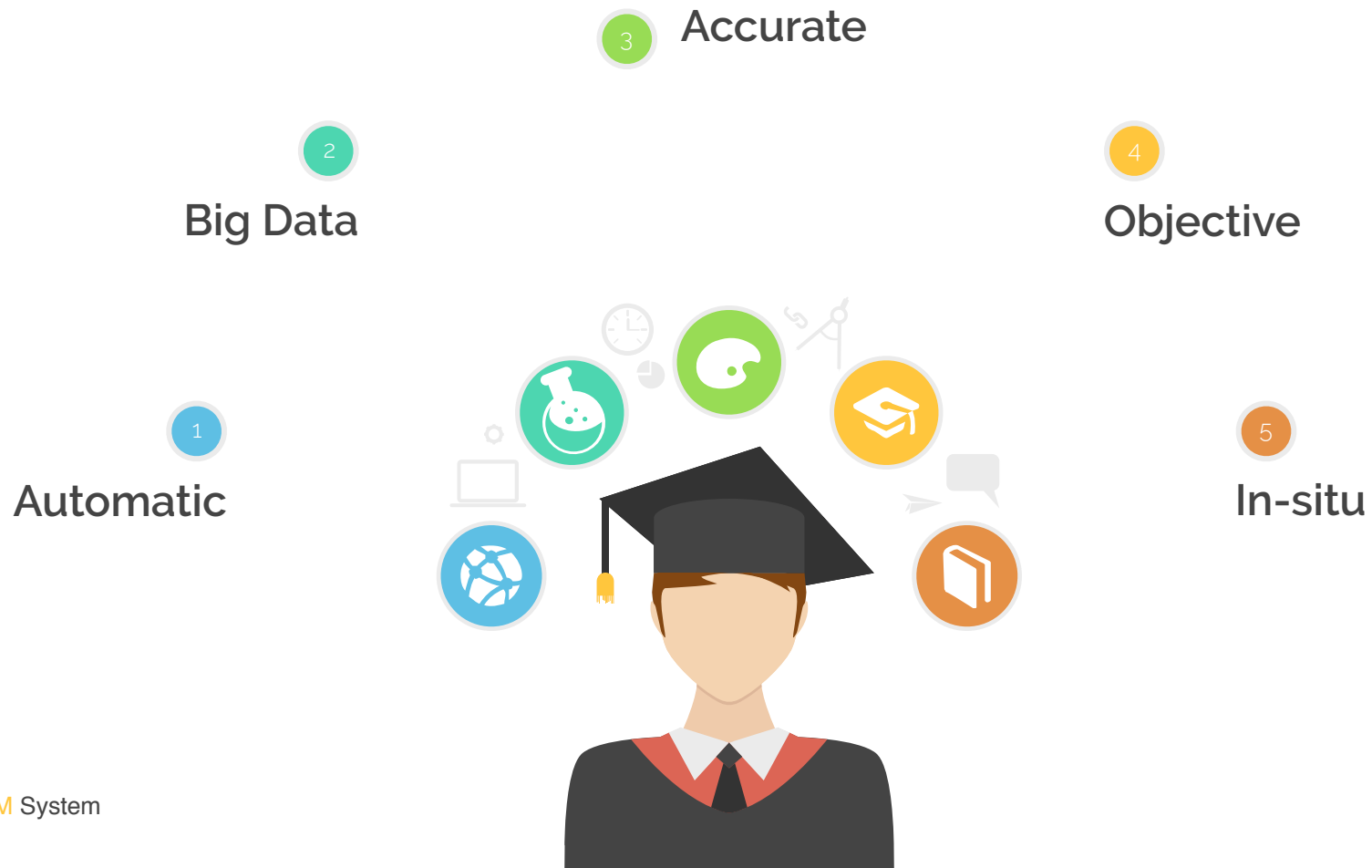
~4.4km² campus
~57,000 population

>2,700 APs
>60,000 devices/day
>15,000 app users

~700 volunteers
~800 courses

EDUM System

for Education Measurements





¡Gracias!

¿Preguntas?



zmoony



<http://zmy.io>



zmoony