

EDUCATIONAL METHODS FOR INVERTED-LECTURE COMPUTER SCIENCE CLASSROOMS TO OVERCOME COMMON BARRIERS TO STEM STUDENT SUCCESS

KATHLEEN M. TIMMERMAN, DOCTOR OF PHILOSOPHY CANDIDATE, COMPUTER SCIENCE AND ENGINEERING

MICHAEL RAYMER, ASSOCIATE DEAN FOR RESEARCH AND GRADUATE STUDIES, COLLEGE OF ENGINEERING AND COMPUTER SCIENCE

JOHN GALLAGHER, PROFESSOR OF COMPUTER SCIENCE

TRAVIS DOOM, ROBERT J. KEGERREIS DISTINGUISHED PROFESSOR OF TEACHING

ALL OF WRIGHT STATE UNIVERSITY



Motivation and Interest

Opportunity

Psychosocial Skills

Cognitive Skills

Academic Preparation

3 GROUPS

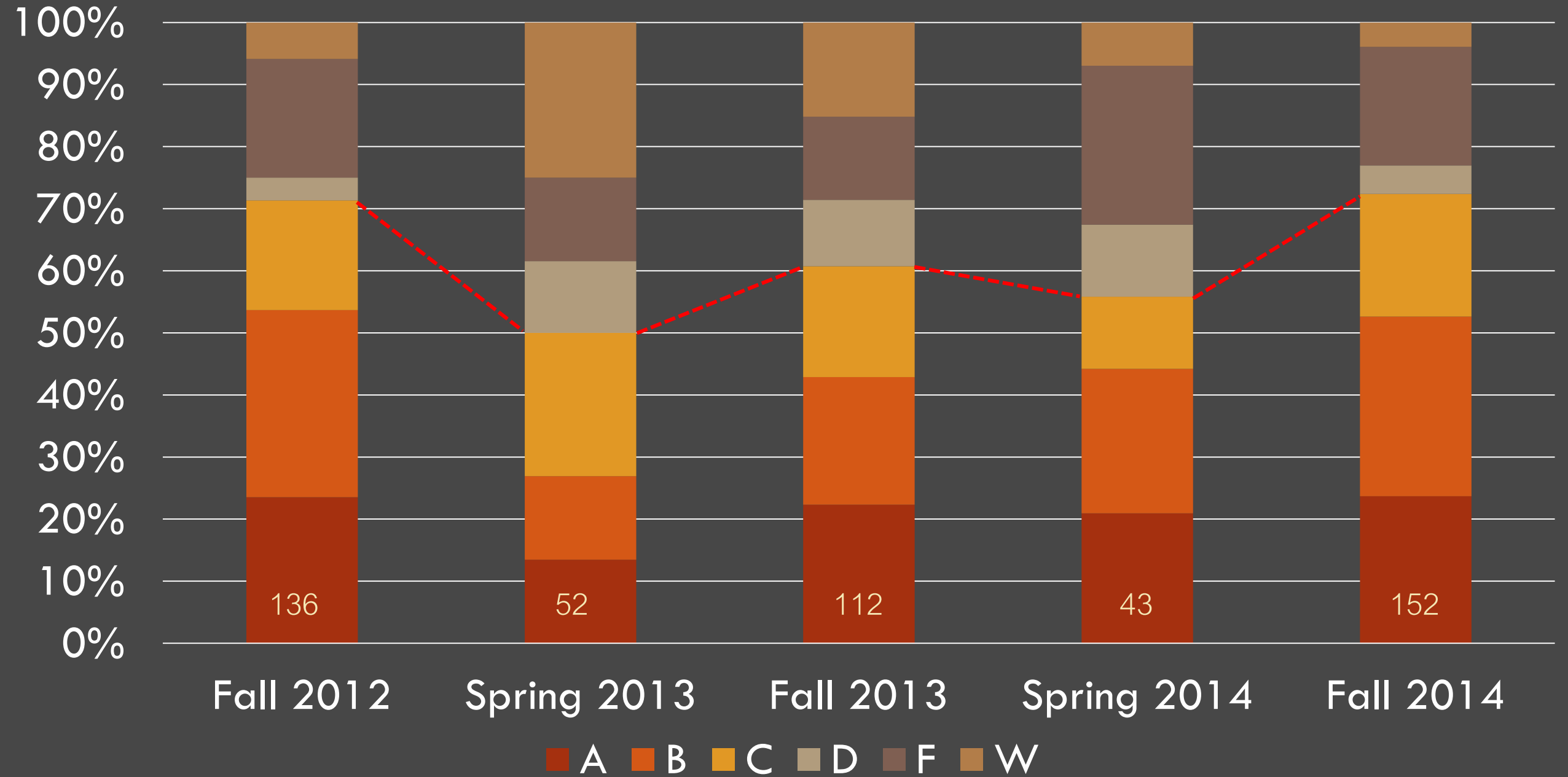
ALE (95)

Flipped(56)

Flipped++(28)

The amount of active learning.

Spring Grades Versus Fall Grades



ALE

Homework

- Read Text



Classroom

- 2-3 point Quiz
 - 1500 pts total
- Lecture $\frac{1}{2}$ Class
- Activity $\frac{1}{2}$ Class

FLIPPED

Homework

- Read Text
- Assigned ungraded problems
- Optional Videos
- Pre Quiz

In
Class

Classroom

- Activity
- Process Activity
- Mondays/Wednesdays Activity
- Friday Post Quiz

FLIPPED ++

Homework

- Watch Videos

In
Class

Classroom

- Activity
- Process Activity
- Activity
- Post Quiz, 4 questions
 - Time executed varied
- Barrier Interventions

• In Class

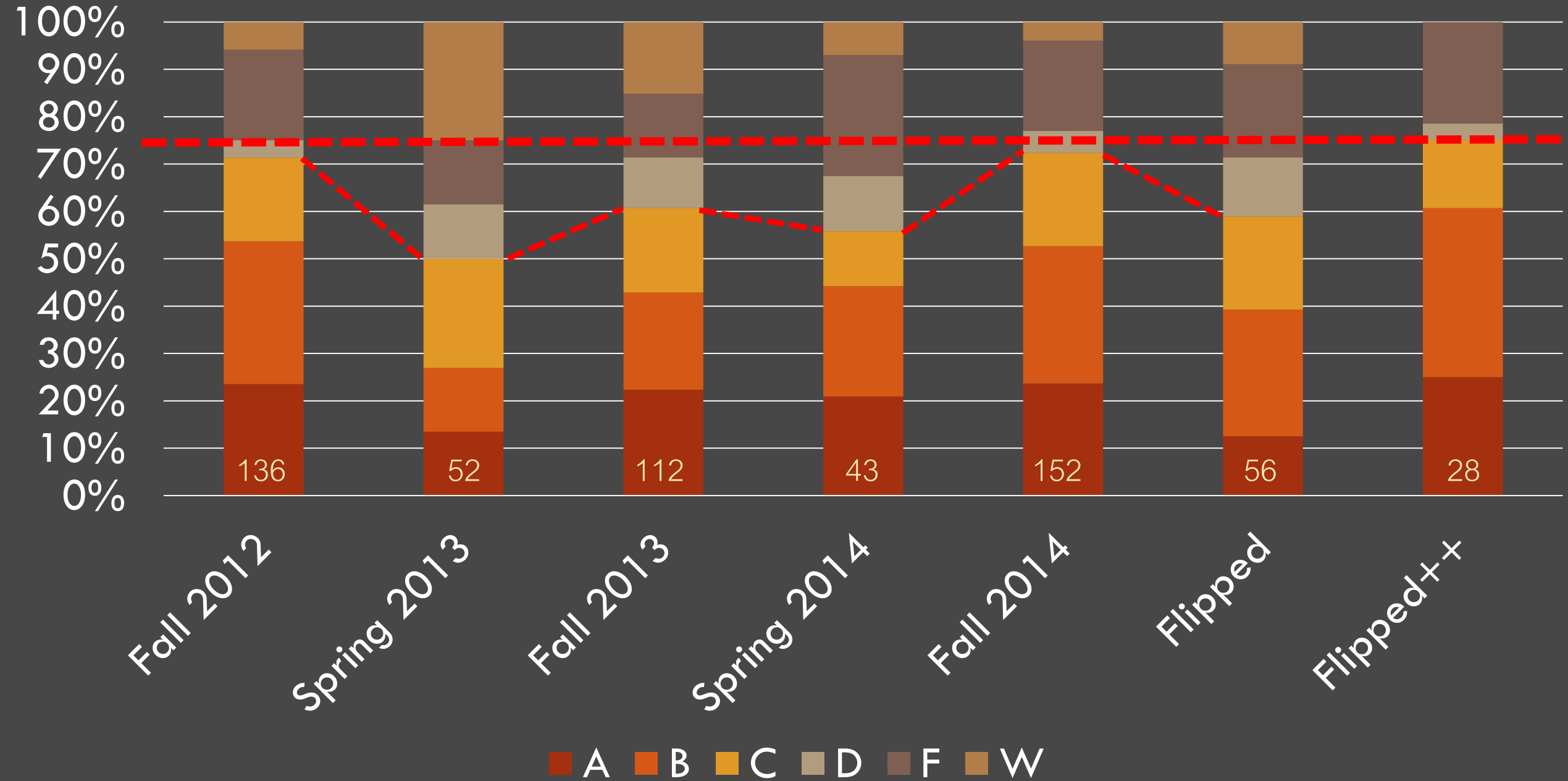
Study

• Activities

• Quizzed

Assigned
Videos

Grade Distribution





Barrier One – Motivation and Interest

- Real World Activities
- Open Ended Projects
- + Define Computer Science, what a computer scientist does, and how it is different from programmers.
- + Discussed sub categories within computer science and computer engineering.



Barrier Two – Opportunity

- Activities

- realistically compare themselves to their peers
- prepare for interview experiences

- + Job Opportunities (Current & Expected)

- + Stated skills from activities used in interviews
- + different types



Barrier Three – Psychosocial Skills


- Activities
 - Advocate position
 - interpersonal interaction skills
 - prepare for interview experiences
 - realistically compare themselves to their peers.

+Cognitive Bias

+Cultural Competencies



Barrier Four – Cognitive Skill

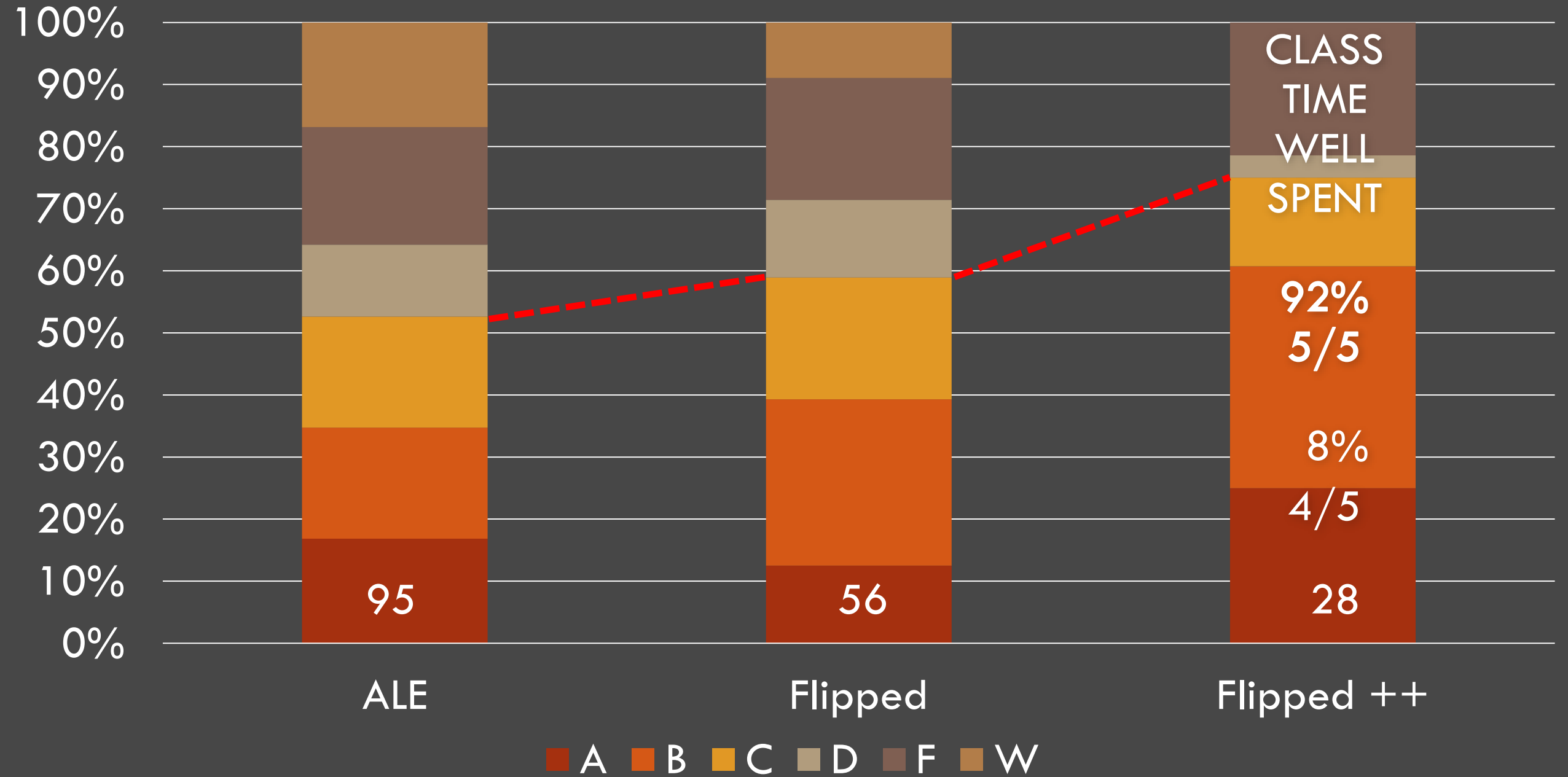
- Activities
 - Communication – Work in Teams
 - Problem Solving – They are solving problems
 - Reasoning – Discuss why they believe that is the answer
 - Decision Making – Must choose a method for solving
 - Critical Thinking – Compare their solutions to other solutions
- 



Barrier Five – Academic Preparation

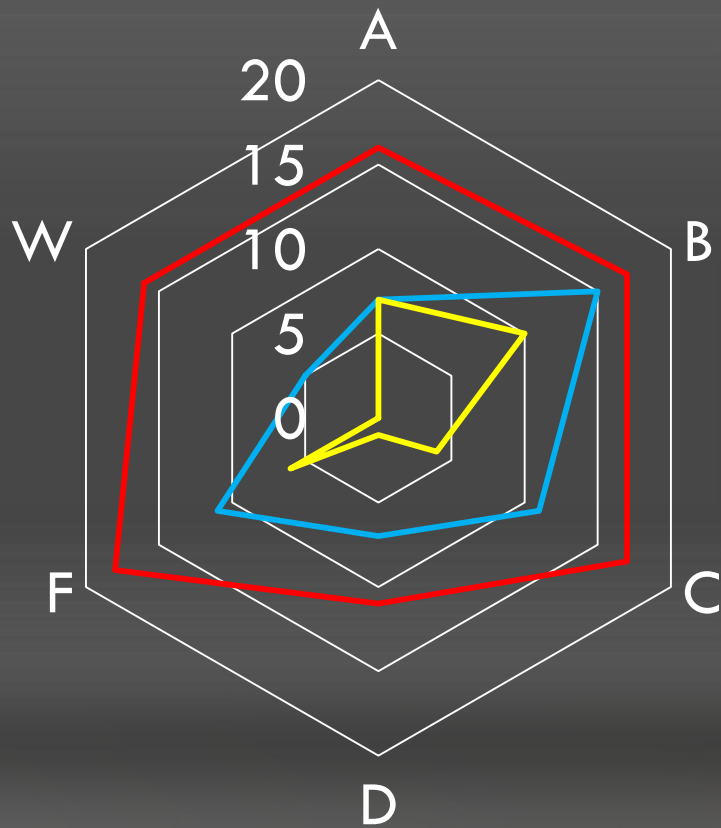
- Frequent Low impact quizzes
- + Pre-posted Video Lectures

Grade Distribution



Grade Distribution

— ALE — Flipped — Flipped ++



SOME NEXT STEPS


- Fall Semester
- Under represented groups
- Retained Knowledge
- Student retention
- Continuous impact when applied to subsequent courses



THANK YOU

Association of American Colleges and Universities, TIDES, and PKAL for your support and funding of this project.

QUESTIONS?



Katie Timmerman
Wright State University
Computer Science and Engineering
P.h.D. Candidate
Timmerman.16@wright.edu