

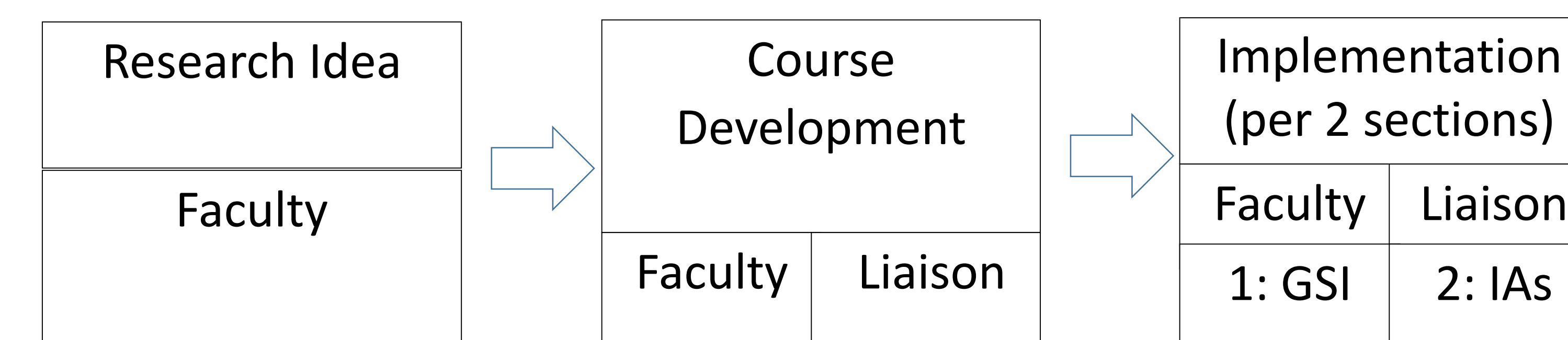
Background

- One major issue in higher education is retention of science majors
- Course-based undergraduate research experiences (CUREs) emerging new trend to show gains in retention.¹
- One major gap in understanding CUREs is the variability in design and implementation to achieve similar gains as apprenticeship-style research.¹

Objectives

1. Create and implement a model to incorporate faculty-led research projects into introductory Chemistry and Biology laboratories.
2. Determine whether authentic research in introductory laboratory classes has an impact on students' attitude, interests, confidence and self-efficacy in STEM and ultimately on graduation rates of STEM majors.

Authentic Research Connection Model



Courses

Chemistry 125/126

- 2 credit lab course
- Taken primarily by 1st year students
- No prerequisite required
- ~ 1700 students enroll per year

Biology 173

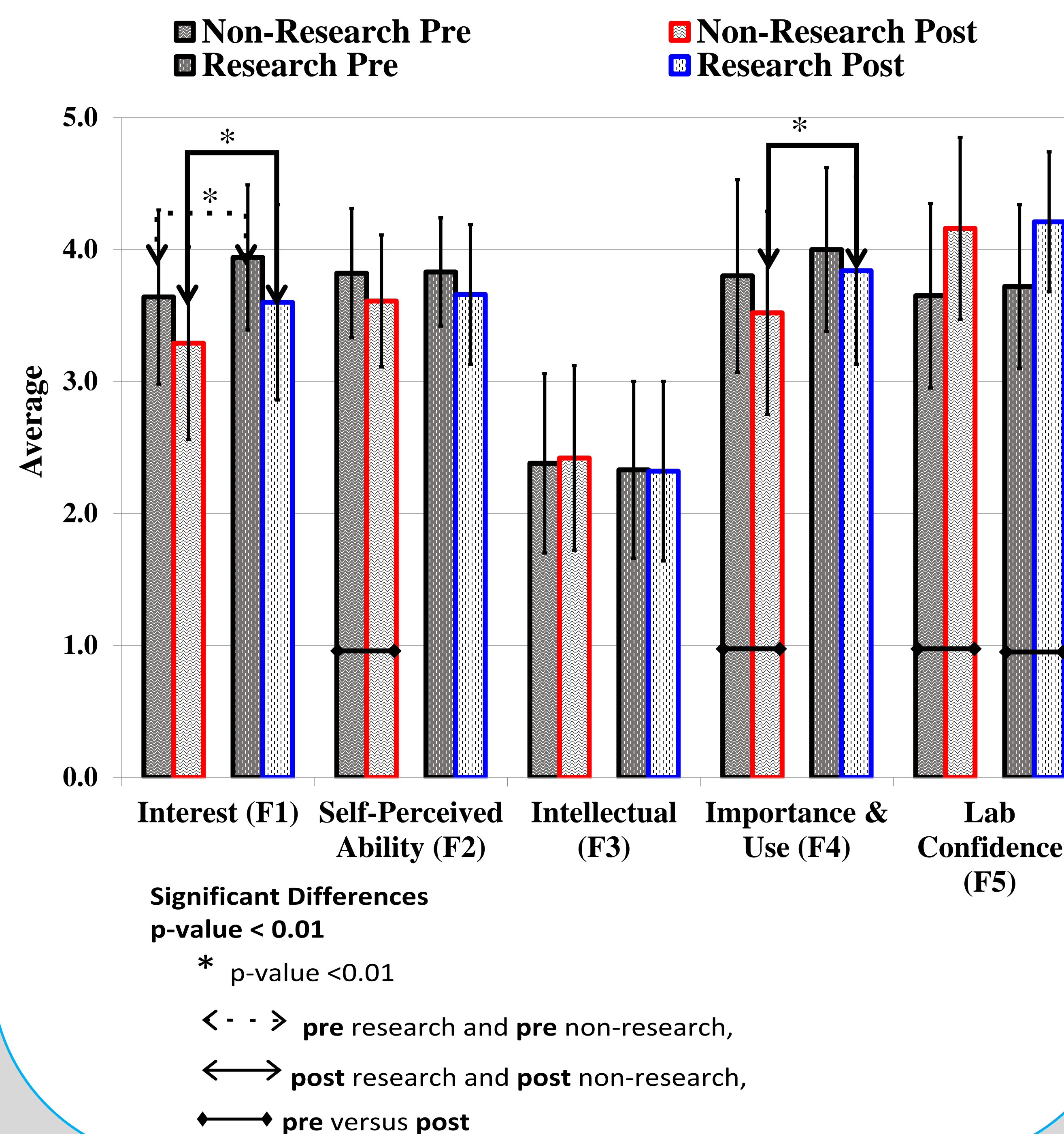
- 2 credit lab course
- Taken primarily by 2nd year students
- Bio 171 or 172 or AP credit required
- ~1800 students enroll per year

Pre/Post Survey Factors

Factor Number	Factor Name	Survey Source
F1	Interest: Initial & Maintained	Harackiewicz et al. ² Ferrell & Barbera ³
F2	Self-Perceived Ability (Persistence)	Ferrell & Barbera ³
F3	Intellectual Accessibility	Bauer ⁴
F4	Importance & Use	Bauer ⁴
F5	Lab Confidence	Brownell et al. ⁵

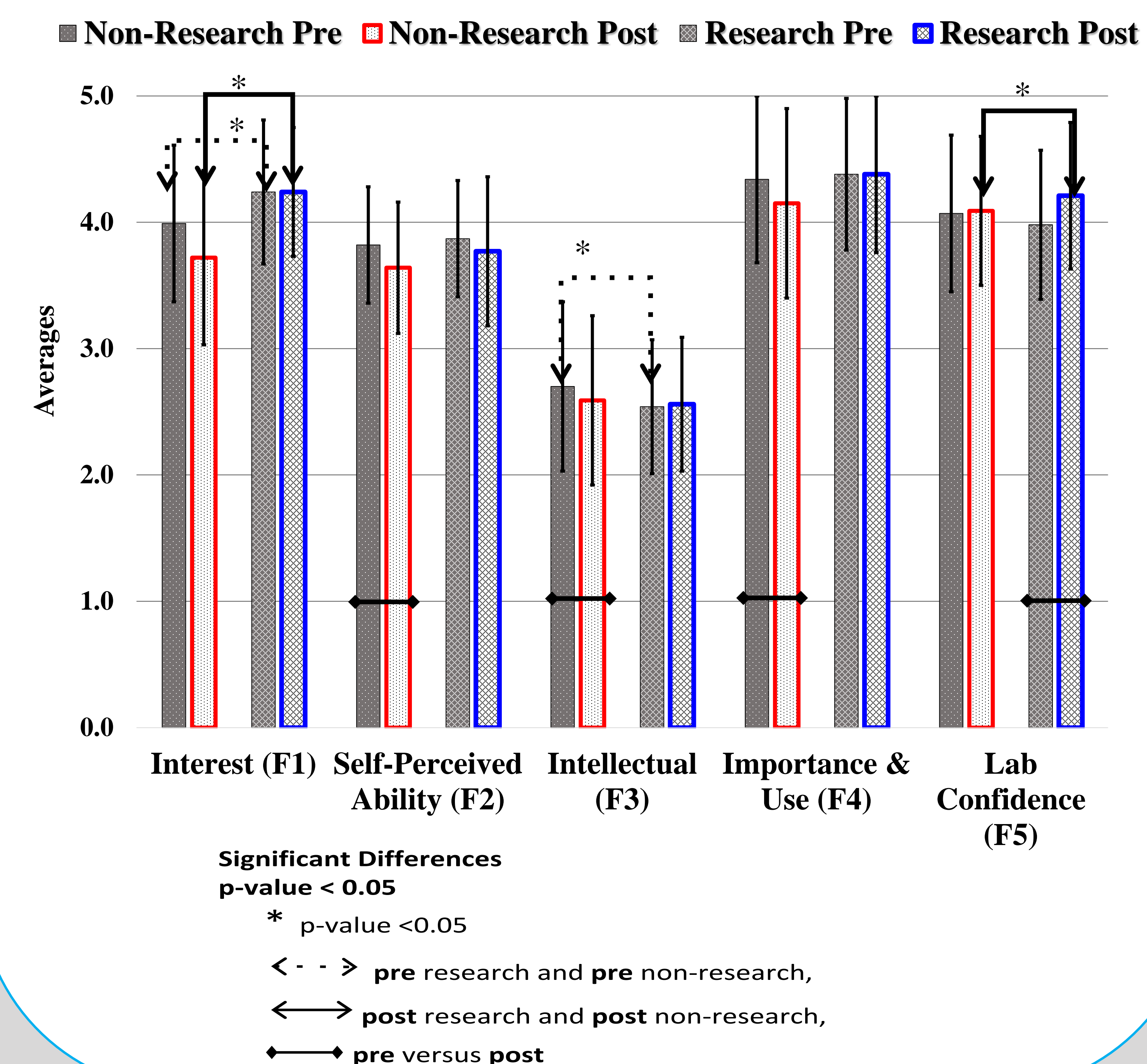
CHEMISTRY 125/126 Fall 2015

	Sections	Students Enrolled	Students Participated in Pre/Post Survey
Research	4	58	43
Non-Research	48	1044	700



BIOLOGY 173 Fall 2015

	Sections	Students Enrolled	Students Participated in Pre/Post Survey
Research	4	80	57
Non-Research	32	575	415



Conclusions

- Research sections maintained students' interest in chemistry or biology over the semester, while interest declined in the regular sections.
- Student confidence in their laboratory skills was significantly higher in Biology research sections than regular sections at the end of the semester.
- Student perception of the importance and usefulness of Chemistry was significantly higher in Chemistry research sections than regular sections at the end of the semester.

Future Work

- Increase the number of faculty led research projects in both Chemistry 125/126 and Biology 173
- Conduct one on one student interviews to understand students perception of the research sections

Acknowledgments

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References

1. Corwin et al. "Modeling Course-Based Undergraduate Research Experiences: An Agenda for Future Research and Evaluation" (2015)
2. Harackiewicz et al. "The role of achievement goals in the development of interest: Reciprocal relations between achievement goals, interest, and performance." (2008)
3. Ferrell, Brent, and Jack Barbera. "Analysis of students' self-efficacy, interest, and effort beliefs in general chemistry." (2015)
4. Bauer. "Attitude toward chemistry: a semantic differential instrument for assessing curriculum impacts." (2008)
5. Brownell, Sara E., et al. "Undergraduate biology lab courses: comparing the impact of traditionally based "cookbook" and authentic research-based courses on student lab experiences." (2012)