

Development of Physics Affinity in Introductory Physics for Life Sciences

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NSF 2142074

IPLS at Swarthmore

The Swarthmore Introductory Physics for Life Sciences (IPLS) course foregrounds authentic biological content in an effort to make physics **durably relevant** and **meaningfully engaging** to life science students.

Prior Longitudinal Findings

Student attitudes about the **relevance of physics** to the life sciences have been shown to **improve during the IPLS sequence at Swarthmore**, and these **gains persist for at least a year or more** (1).

Research Question

How does the Swarthmore IPLS sequence support the observed longitudinal gains?

Physics Affinity Survey

We identified three dimensions that have been shown to impact learning and motivation. Items selected from validated instruments (2).

Interest

Ex.

"When I'm working on something in physics that I think is interesting, I continue working even when it takes a lot of time."

Self-efficacy

Ex.

"I do not worry about my ability to solve physics problems."

Physics Relevance

Ex.

"Physics is relevant for understanding biological processes."

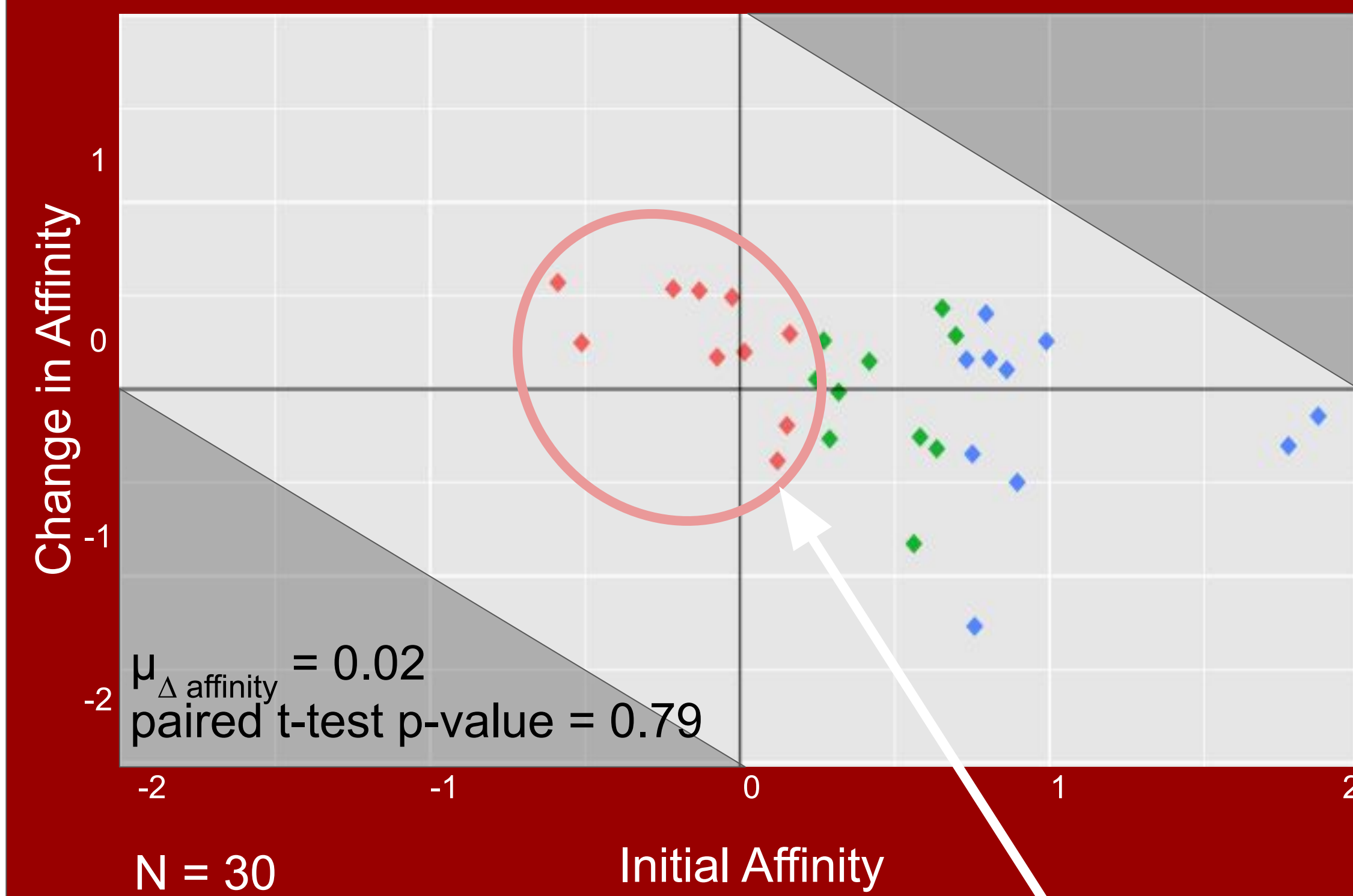
Physics Affinity

Analysis of Surveys

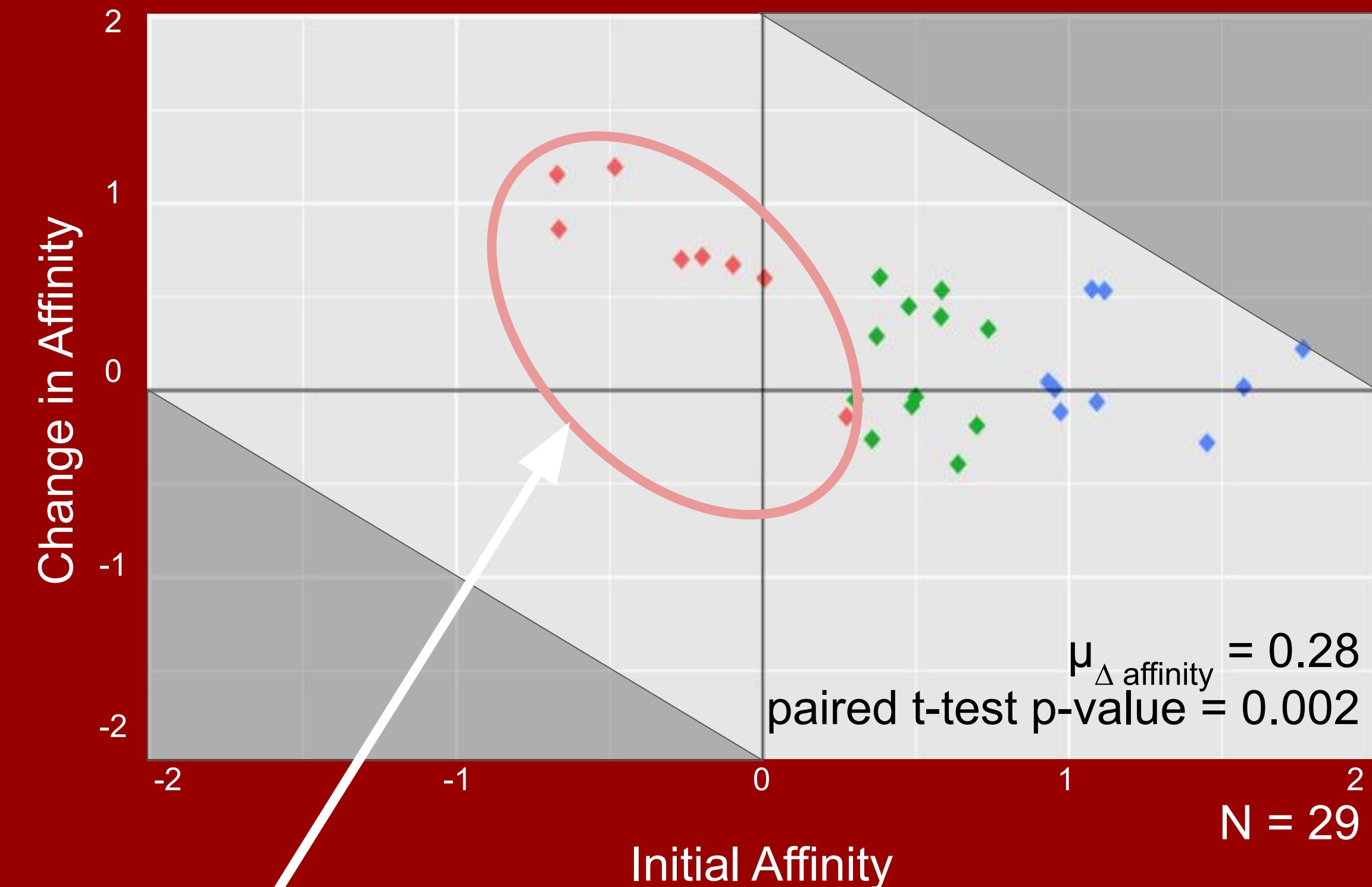
- Matched data across each semester of the IPLS sequence
- Converted 1 to 5 Likert scale (Strongly Agree/Disagree) to a -2 to 2 scale
- Restricted data to life science students only

Overall affinity scores improved significantly only in IPLS 2

Swarthmore IPLS 1: Change in Affinity vs Initial Affinity



Swarthmore IPLS 2: Change in Affinity vs Initial Affinity



Initial Affinity Levels
 ◇ Low (N = 10)
 $\mu_{\Delta \text{affinity}} = 0.24$
 paired t-test p-value = 0.04
 ◇ Medium (N = 10)
 $\mu_{\Delta \text{affinity}} = -0.04$
 paired t-test p-value = 0.75
 ◇ High (N = 10)
 $\mu_{\Delta \text{affinity}} = -0.14$
 paired t-test p-value = 0.2

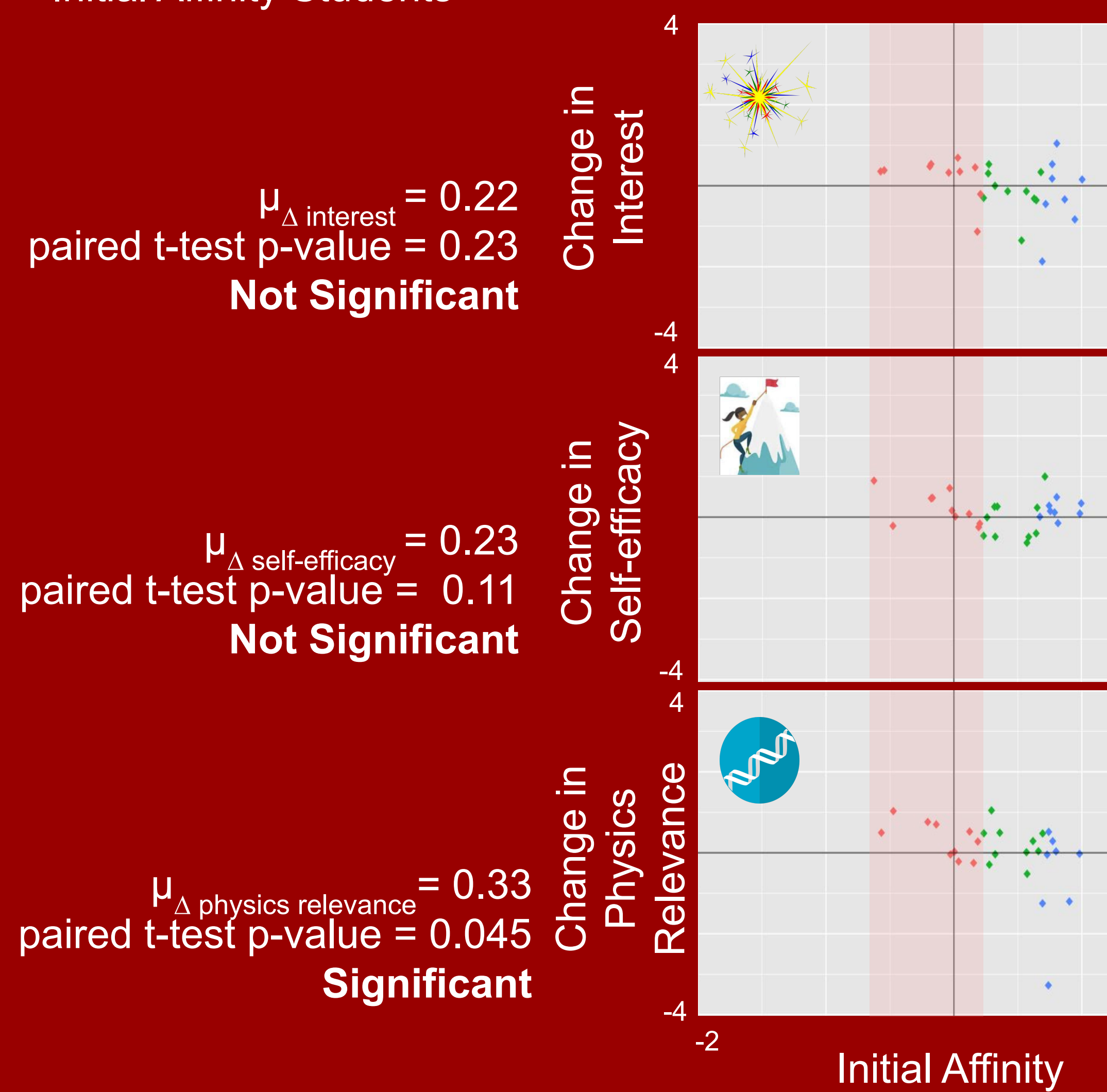
Initial Low Affinity students improved significantly in both IPLS 1 and IPLS 2

In different courses, different dimensions of physics affinity showed the most substantial changes

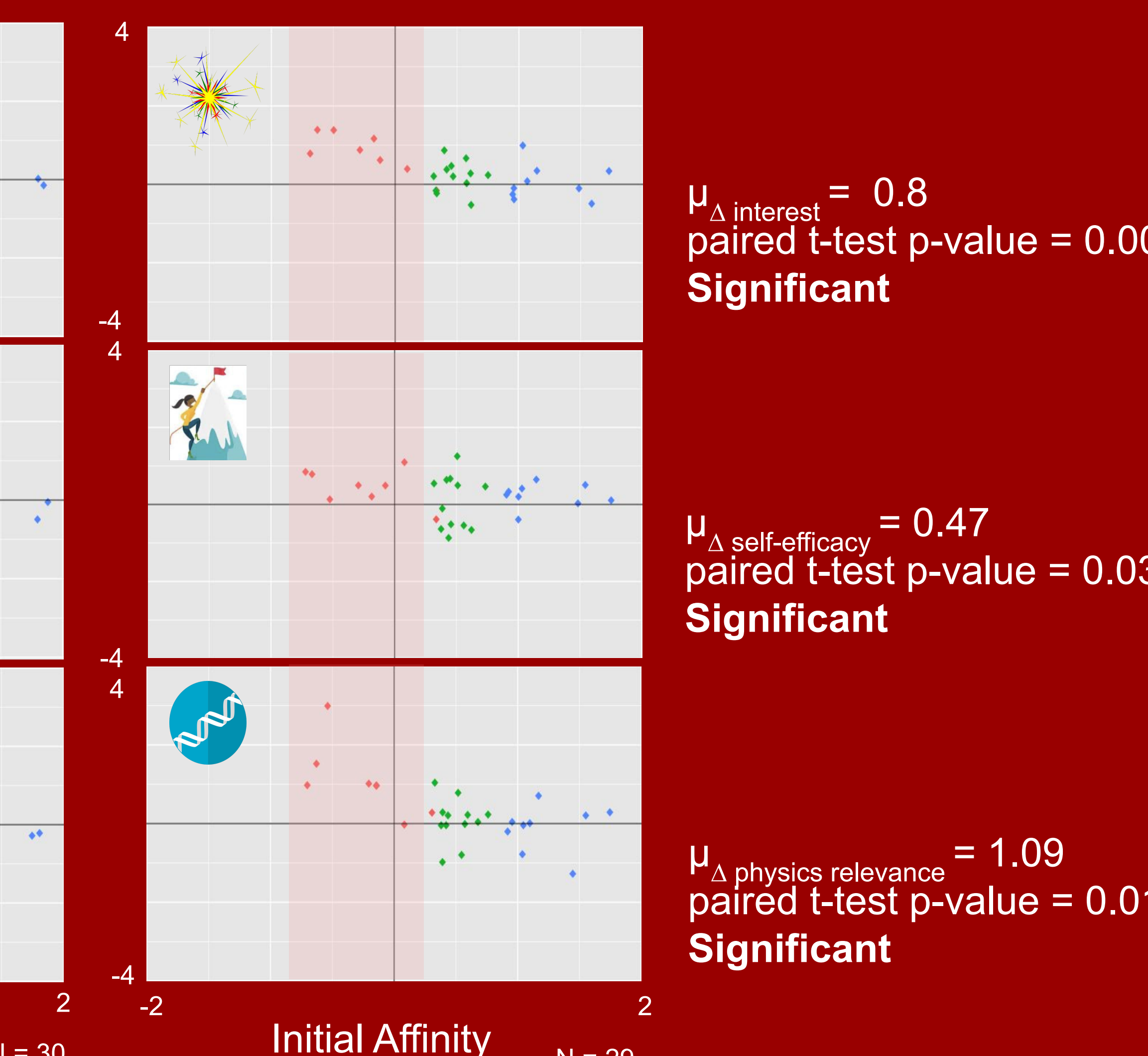
Initial Affinity Levels
 ◇ Low (N = 8)
 $\mu_{\Delta \text{affinity}} = 0.73$
 paired t-test p-value = 0.002
 ◇ Medium (N = 12)
 $\mu_{\Delta \text{affinity}} = 0.13$
 paired t-test p-value = 0.23
 ◇ High (N = 9)
 $\mu_{\Delta \text{affinity}} = 0.09$
 paired t-test p-value = 0.35

All Statistics Below are for Low Initial Affinity Students

IPLS 1

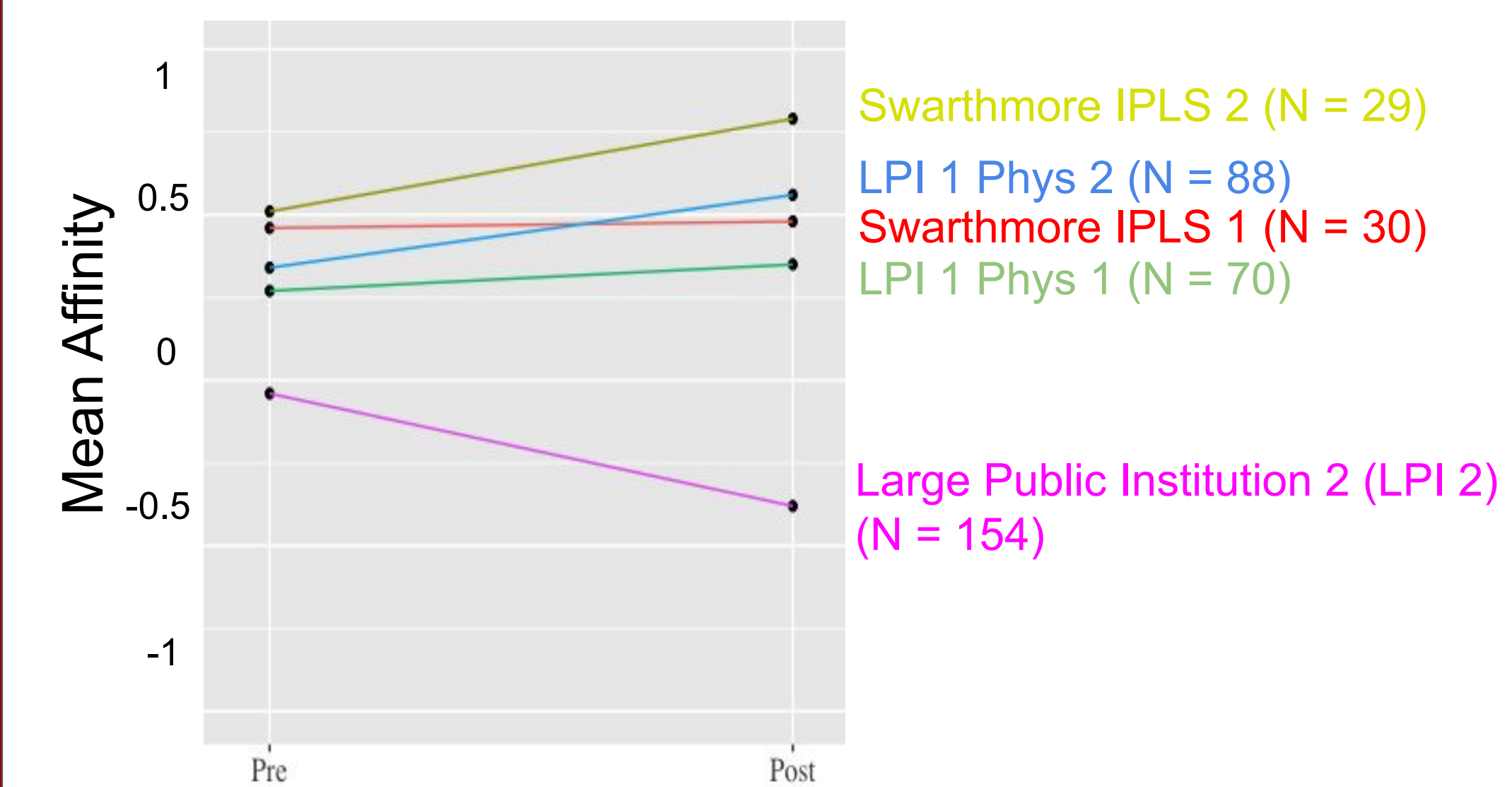


IPLS 2

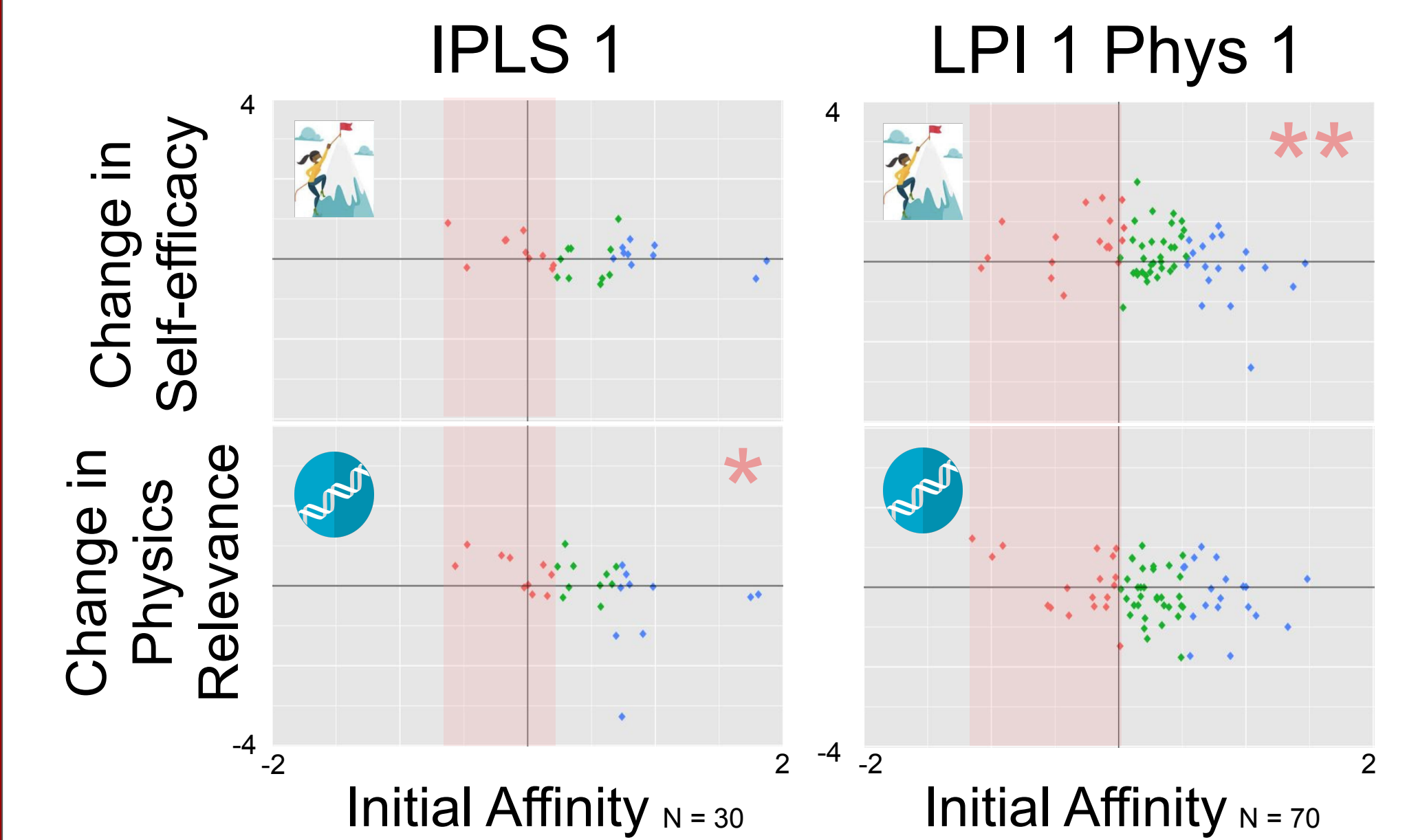


Comparisons of Affinity Scores across Institutions

Mean Affinity at Different Institutions



Initial affinity scores vary by course. Depending on these initial levels, some dimensions of the total affinity may be more significant than others in contributing to the observed changes.



Among low initial affinity students, only significant change in physics relevance (IPLS 1) and self-efficacy (LPI 1 Phys 1).

In different courses, different dimensions of physics affinity showed the most substantial changes among the initial low affinity students.

References

- Rak et al., 2019 AAPT Talk
- Michaelis and Nathan (2015), Four-Phase Interest Development in Engineering Survey, FIDES 2.0; Fencil and Scheel (2004), Physics Self-Efficacy Survey, PSES; K. Hall thesis (2012), MBEX Interdisciplinary Cluster items

Acknowledgements

Thank you to Andrew Boudreaux (WWU), Eric Brewé (Drexel), Tim Nokes-Malach (Pitt), and Laura Ríos (Cal Poly) for serving on our advisory board. Thank you to Professors Geller (PI), Crouch (co-PI), Renninger (education department and senior consultant), and Hackler (faculty contributor) for your guidance and support. As well, thank you to my undergraduate colleague Drake Roth '25. This research was funded by NSF DUE 2142074 and Swarthmore College.