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Earning a CS Minor: A Not-So-Minor Feat

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Why CS Minors Matter

Route into the major — Minors serve as an exploration pathway for students discovering CS later in their academic journey

Interdisciplinary skills — Build computational thinking alongside primary field expertise

Career adaptability — Gen Z+ expected to change jobs frequently; minors strengthen versatility

Growing demand — Computational thinking skills increasingly required across all STEM fields, increased in “Age of AI” not decreased

RESEARCH GAP

Most research focuses on CS majors. Minors remain understudied.

54% of students choose a minor in their 2nd year, 30% in their 3rd year

Minors must be completable in 2 years

Methodology

120

Universities examined

R1 Schools Sorted by CS completion rates (IPEDS)

104

CS minors analyzed

16 excluded: no minor or incomplete data

107

Additional minors found Across 59 universities

Data Science, Cybersecurity, etc.

1. DATA COLLECTION

Built program maps from public-facing websites for each minor

2. CREDIT ANALYSIS

Compared advertised vs. actual credits, normalized to institutional norms

3. COMPLEXITY METRICS

Used Curricular Analytics for structural complexity, delay factor, centrality

Assumptions: Student is calculus-ready • No prior CS experience • Chooses shortest path to completion

Finding 1: Systemic Entry Barriers

Requirements that limit access before students can even start

70%

of minors have entry requirements

73 of 104 programs studied

COMMON ENTRY REQUIREMENTS

CS 1

Prerequisite course required before declaring, often multiple courses

Calculus I

Math prerequisite often required

GPA Min

Minimum GPA barriers

Impact: These requirements create systemic barriers, limiting accessibility for students who want to explore CS from other disciplines.

Finding 2: Hidden Requirements

52.88%

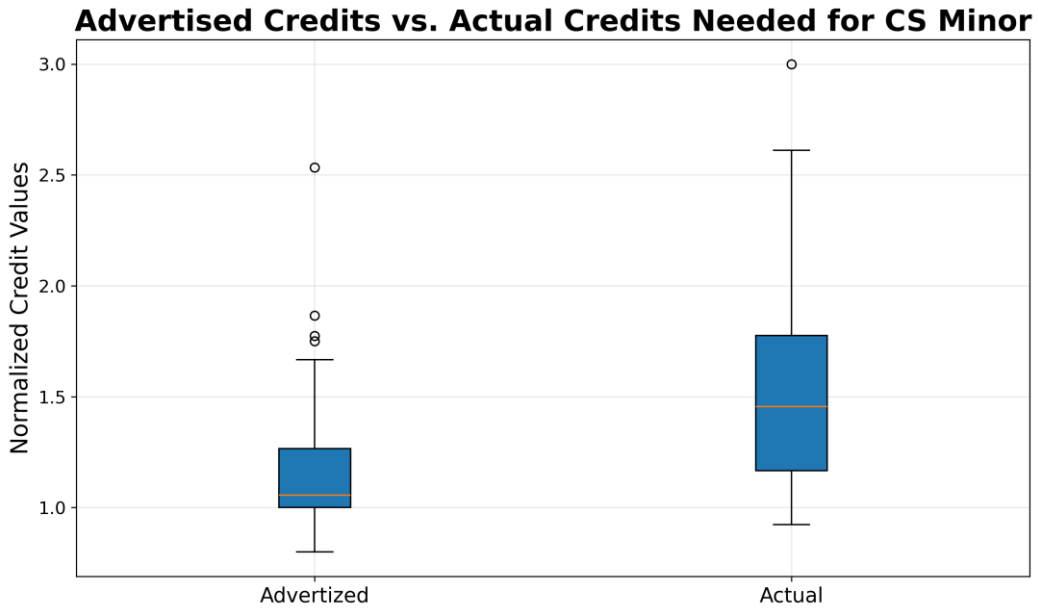
Have hidden requirements

50%

Require Calculus

52.88%

Require Discrete Math



1.0 indicates Minor matches institutional norm

Math requirements are often not included in advertised curricula but are prerequisites to required courses.

Additionally: Many CS minors have 3-4 more courses than the typical institutional minor requirements

Finding 3: High Structural Complexity

Rigid prerequisite chains limit flexibility and extend time to completion

DELAY FACTOR (MINIMUM SEMESTERS)

75%

of minors require 4+ semesters

40 programs require 5 or 6 semesters

That's 2+ years minimum to complete

STRUCTURAL COMPLEXITY

66%

High structural complexity / interlocking courses

Some programs – higher complexity than full degree programs!

High structural complexity = little room for error. If a student fails one course, their entire progress can be blocked.

Problem: Most students decide on minoring in year 2 or 3, making many CS minors unattainable.

Bottleneck Courses

TOP 5 COURSEs	COUNT	%
Data Structures & Algorithms	**57**	**54.8%**
Computer Science 1	18	17.3%
Object-Oriented Programming	13	12.5%
Discrete Mathematics	12	11.5%
Intermediate/Advanced Programming	10	9.6%

This is also true for majors (discussed next session)

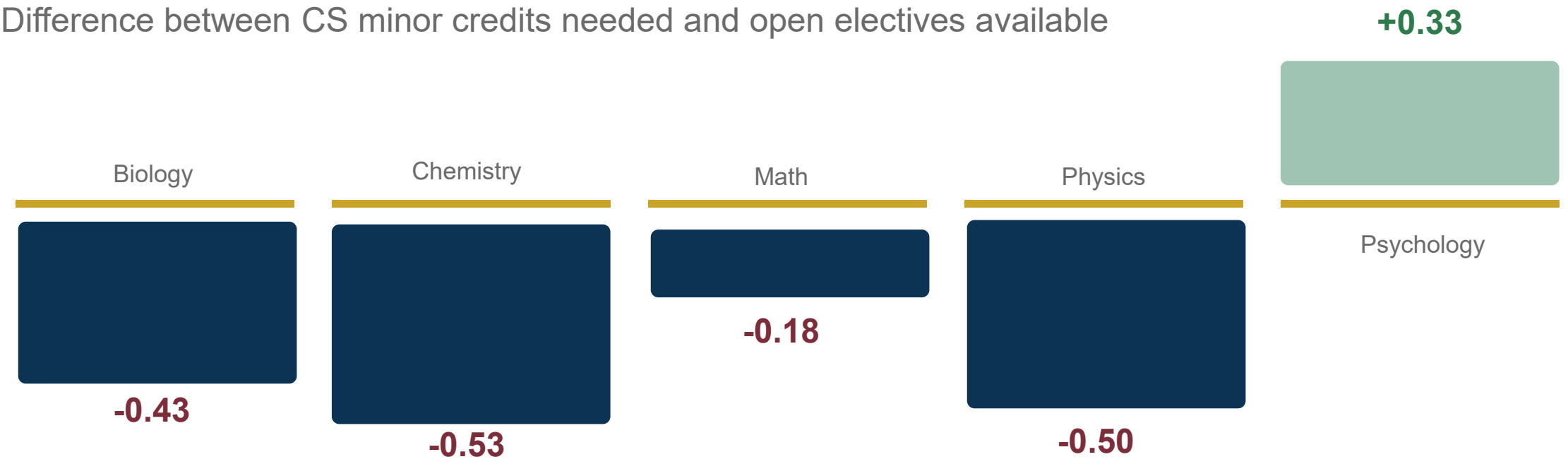
KEY BOTTLENECK:
Data Structures

Highest centrality in over half of all programs studied

Implication: If a student fails Data Structures and needs to repeat, their progress is functionally blocked — possibly motivating them to drop the minor entirely.

Finding 4: STEM Majors Can't Fit CS

Difference between CS minor credits needed and open electives available



Negative values = students need 2-3 additional courses beyond typical degree requirements, not including other electives!

Only Psychology has enough open credits to complete CS minor with room to spare

Values shown are median normalized credit differences. Zero = exact fit.

Beyond the CS Minor…

107 additional minors offered by CS departments at 59 of the 120 universities

17 Data Science	**15** IT	**10** Bioinformatics	**10** Cybersecurity
8 Applied Computing	**7** Engineering	**6** Systems/Networks	**5** AI/ML
5 Robotics	**5** Software Dev	**19** Other	

PATTERN OBSERVED

Schools offering one additional minor tend to offer **multiple** — 107 minors across just 59 schools.

Gap: Only 3 HCI minors found despite Psychology being the most popular major on many campuses.

"Other" includes: Human-Centered Computing, Digital Design, Game Design, Web Design

Recommendations

Actions CS departments can take to improve minor (and major) accessibility

1

Rethink Prerequisites

Ensure prerequisites are aligned with content truly needed for the minor, not inherited from major requirements.

2

Reconsider Calculus

Should Calculus be a prerequisite for a minor? It serves as a barrier for non-STEM students exploring CS.

3

Be Transparent

Publicly advertise ALL requirements including hidden prerequisites. Students need accurate info to plan.

4

Reconsider Entry Barriers

If students can succeed in CS coursework, are GPA minimums and restricted entry requirements truly necessary for a minor?

5

Create Interdisciplinary Pathways

Partner with other departments to create accessible pathways. A minor today may become a major tomorrow.

6

Enable Early Discovery

Include CS in general education requirements to help students discover computational thinking early.

Powerful Combination

https://cic.northeastern.edu/publications/

Thank You!
&
Questions!

https://cic.northeastern.edu/get-involved/

Presentation Slides

Full Paper

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