Making Nuclear Magnetic Resonance Resonate With Students

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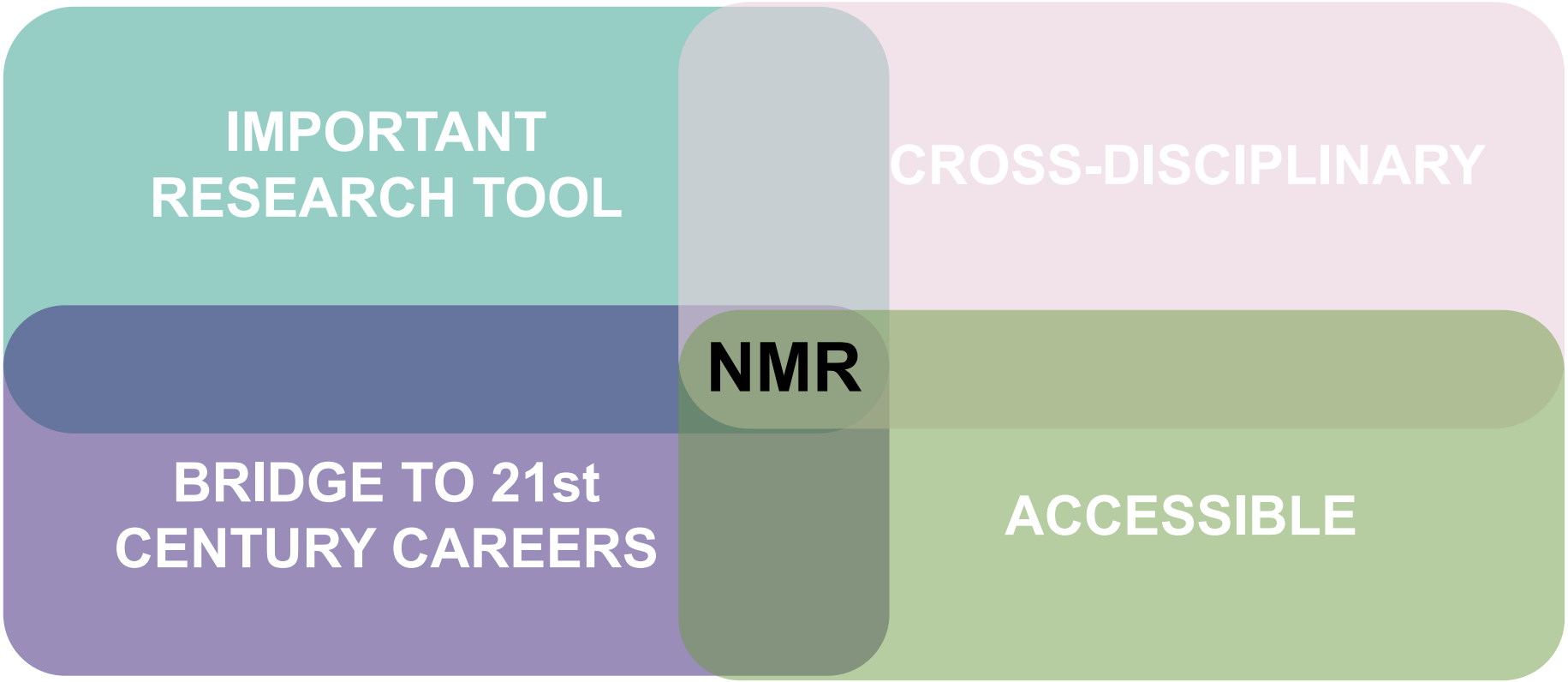
The City College of New York

WHY NMR?


IMPORTANT RESEARCH TOOL
CROSS-DISCIPLINARY
NMR
BRIDGE TO 21st CENTURY CAREERS
ACCESSIBLE

PROJECT GOALS

Developed curricular materials are interdisciplinary and *make use of* ***current pedagogical best practices*** *for an* ***engaged and inclusive science learning environment***.

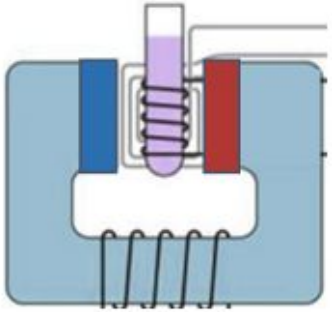
Curricular materials provide students with class-based undergraduate *laboratory experiences that introduce* ***research skills*** *and* ***emulate experimental research*** *in a lab* (with or without direct access to an NMR system).

Curricular materials are *designed to be easily adapted and* ***adopted*** for use in a wide array of educational environments.

WHAT WE HAVE DEVELOPED

Making NMR Resonate

- Home
- Physics Modules
  - Module 1
  - Module 2
  - Module 3
  - Module 4
  - Module 5
  - Module 6
  - Module 7
  - Module 8
  - Module 9
  - Module 10
- Chemistry Modules



Module 1: Why Magnetic Resonance?

Module 1 - PDF

Module 1 - Student Worksheet

MODULES CONTAIN:

- Expected learning outcomes
- Real-world examples
- Featured scientists
- Hands-on activities, simulations, videos of experiments for those without access to equipment
- Research-based pedagogy

Module 1 Instructional Materials

Module 1 - Instructor's Manual

Module 1 - Instructional Slides with Links to Supplemental Materials and Module Assessments

Module 1 - Student Worksheet Answers

Module 1 - Feedback Form

UNDERGRADUATE RESEARCHERS

The 2023 summer crew visiting the NMR facility at CCNY.

Sarah Lawrence College

Lillian Bower
Nicholas Fajardo
Leah Goodall
Jane Joncha
Skyler Kawecki-Muonio
Christina Kefela
Afia Khan
Ashley Spector-Townsend
Christian Tarrasch
Chris Torres

City College of New York

Mahisha Akhand
Bibi Zameena Alli
Sophia Jiang
Sammely Perez
Racquel Scott
Taylor Tram

Where we are now

Implementations: Implemented all the modules at Sarah Lawrence College, and 4 modules at City College of New York.

Revising the materials and creating instructional materials.

Disseminating our work online as well as leading professional development workshops for faculty to learn how to best adapt the material for their particular needs.

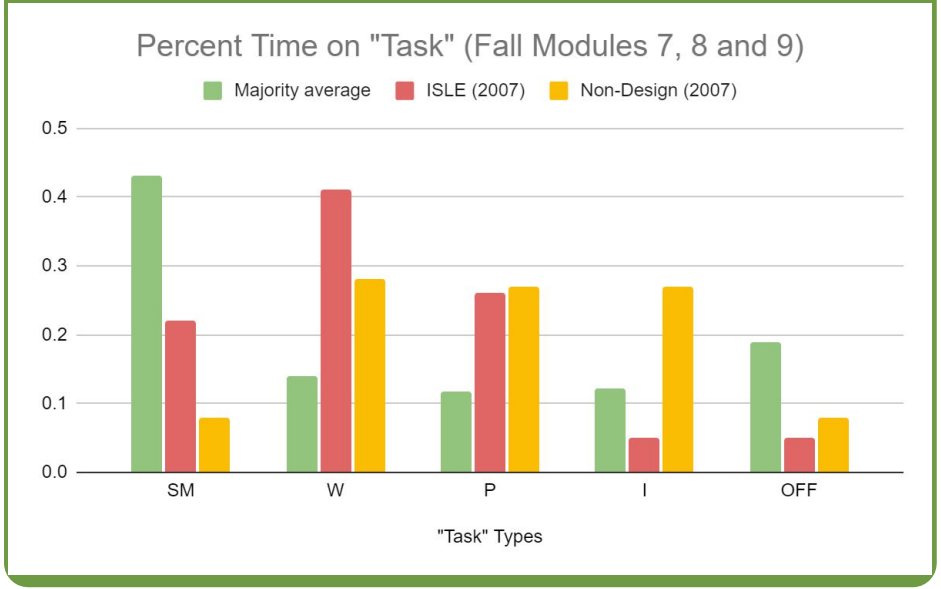
OVERALL

based off instructor and student feedback

- Most of the desired learning objectives are being met
- Students enjoyed using the modules
- Instructors noticed that students were engaged and had increased confidence in answering questions and explaining their reasoning
- Instructors had a very positive experience using the modules and felt that they helped students develop skills in the techniques or procedures of science

LESSONS LEARNED FROM EVALUATION

Students spend a LOT of time sense making (not a lot writing)



Content assessments have **strong scores for all students**

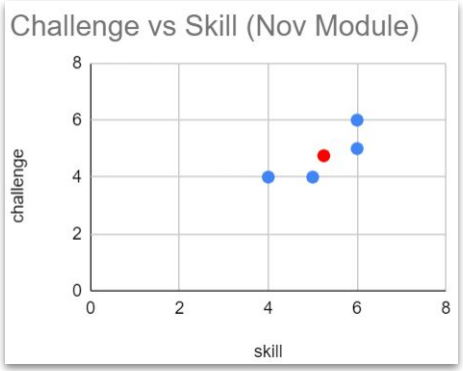
No notable identity shifts - their identities as scientists started and remained strong

Unsurprisingly, **no notable ECLASS shift**

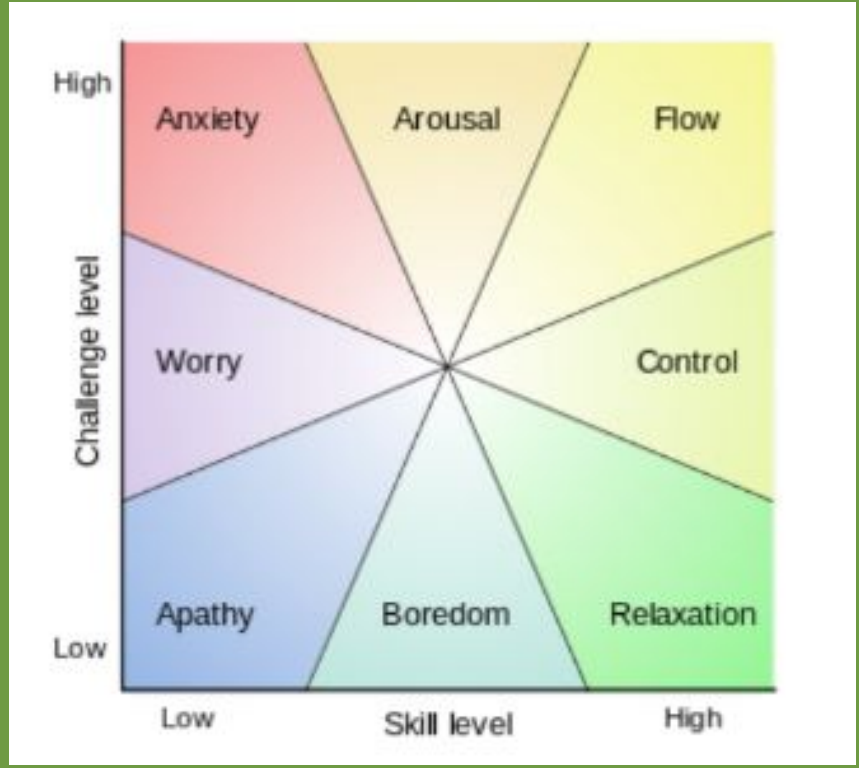
* these are VERY small N results

LESSONS LEARNED FROM EVALUATION

FLOW*: mental state in which a person performing some activity is fully immersed in a feeling of energized focus, full involvement, and enjoyment in the process of the activity



*Named by Csíkszentmihályi in 1970



LESSONS LEARNED FROM EVALUATION

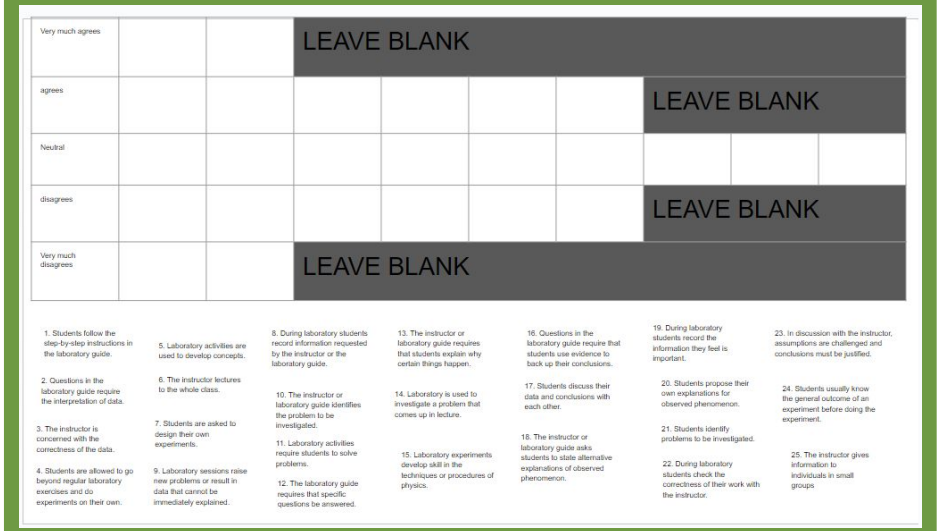
25 Ranked Statements:

Teachers > Students: Laboratory experiments develop skill in the techniques or procedures of physics.

BOTH: Students discuss their data and conclusions with each other.

Students > Teachers: Students follow the step-by-step instructions in the laboratory guide.

Q SORT



INTERESTED IN USING OUR MATERIALS?

This project is designed to benefit all undergraduate science programs but will have the **most impact at primarily undergraduate institutions with limited access to research experiences and historically underserved student populations.**

Scan the QR code to be contacted when the materials are available and/or to provide suggestions of potential resources to include!