

FROM NETLOGO TO LLMs

# A Decade of STEM Integration Professional Development

*and an Emerging Verification Competency Model for Educators*

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# An issue that recurs with every new technology



Educators consistently report that the hardest part of **integrating** new technology into STEM instruction is knowing how to use it and how to check (assess) its outputs.

Each intervention introduced a different technology.

**Each exposed the same issue.**



**Agent-based modeling**

NetLogo



**Microcontrollers**

micro:bit



**Cybersecurity**

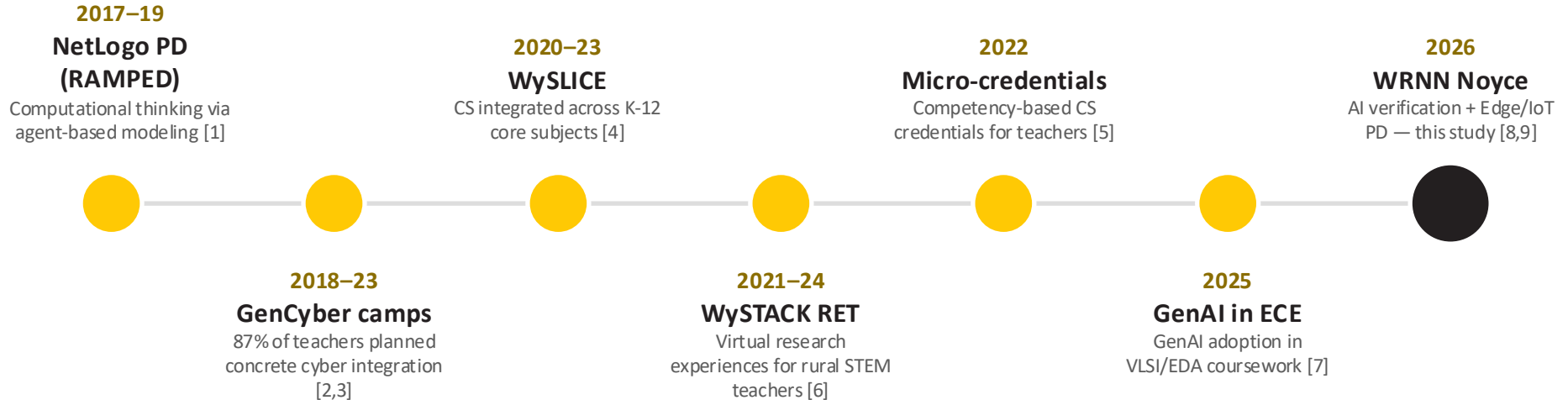
GenCyber camps



**Generative AI**

LLMs

# A decade of iterating integration PD



Bracketed numbers reference the publication list — slide 11.

# Generative AI amplifies the verification problem



## LLMs produce fluent, plausible content

Output that looks authoritative whether or not it is correct. When its wrong, it remains invisible to a non-expert reader/user.

### THE SKILL GAP



Verifying AI output requires domain-specific judgment beyond general digital literacy

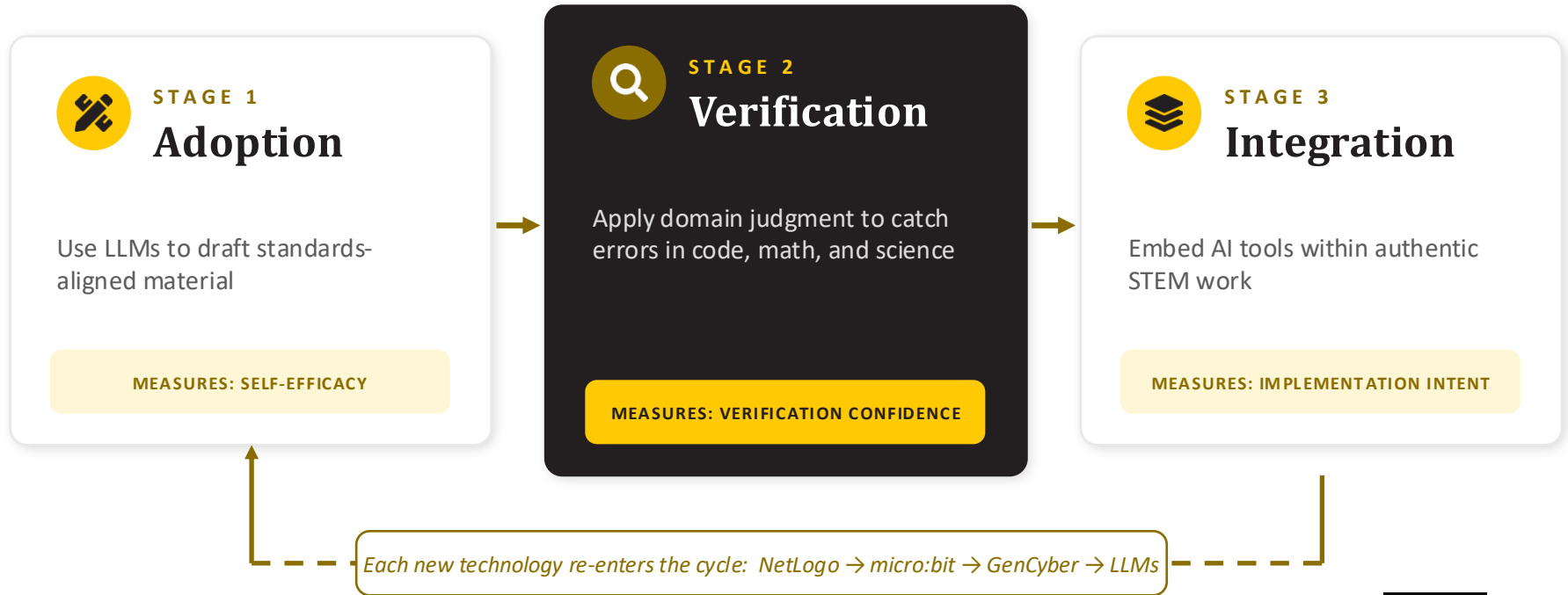


Most STEM educators were never taught these verification practices



Adoption-focused PD teaches teachers to use AI but rarely *how* to audit it

# A three-stage competency progression



***Verification is the pivot, and where self-efficacy gains concentrate.***

# A mixed-methods, multi-cohort exploration



## Baseline cohorts

Pre/post self-efficacy from earlier WRNN virtual sessions and follow-ups establish longitudinal trajectories.



## Current workshop series

WRNN three-stage progression with 33 K-12 educators; matched pre/post pairs (n = 24) across six verification skills.



## University context

128 course experiences (71 courses, nine semesters) plus a 147-student survey frame the AI policy environments students enter.

*Instruments capture self-efficacy, verification confidence, and implementation intent at each stage.*

# WRNN workshop series — Spring 2026

APR 11

## Using AI for STEM

LLMs as a co-pilot: prompt engineering for differentiated, standards-aligned lessons

APR 18

## Verifying STEM AI Outputs

Trust-but-verify: auditing AI-generated code and math; teaching error analysis

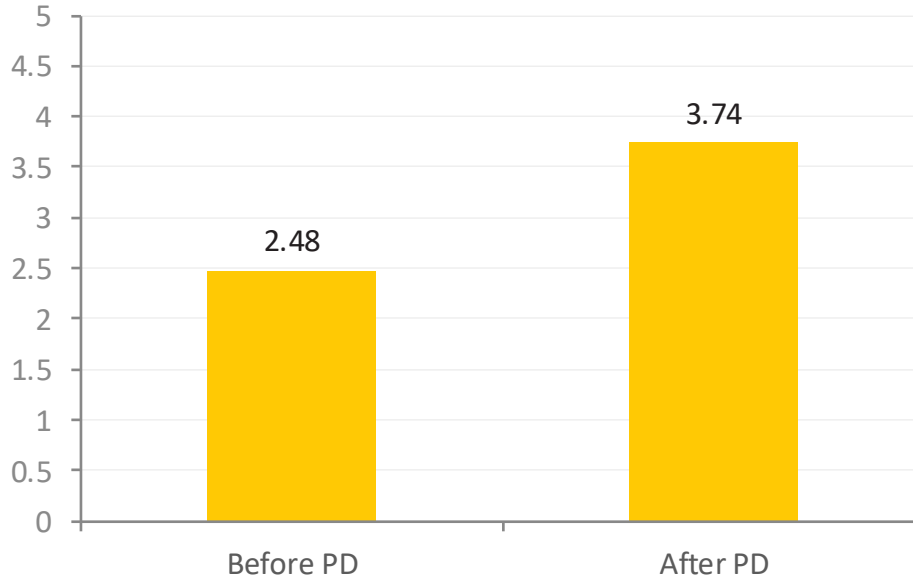
APR 25

## Integrated STEM with Edge/IoT

Programming physical systems with LLM assistance; NGSS/CTE-aligned data

*Delivered Remotely from UCF · Noyce educators selected via lottery · hardware provided to take back to classrooms  
Materials available at [cxedhub.com](https://cxedhub.com)*

# Verification drives the largest self-efficacy gains



Composite of six verification skills, matched pre/post ( $n = 24$ ):  $+1.26$ ,  $d_z = 1.42$ ,  $p < .001$ .



## The largest lift sits on verification itself

**Check the Machine confidence rose  
From 1.65 → 3.35 (+1.70)  
the largest single-skill gain.**

Every skill gained at least +1.00; the pattern holds whether the tool is a microcontroller, a cybersecurity concept, or a Large Language Model (LLM).

# A shift in how educators frame AI

## SINGLE-SESSION PARTICIPANTS



*“AI as a tool that saves planning time.”*

## COMPLETED FULL PROGRESSION



*“AI as something students need to evaluate.”*



**University data reinforce the stakes:** informal “allowed” AI policies yield the lowest student clarity (2.45/5) — below an explicit ban (4.50/5) — and 62.5% of students in AI-banned courses used AI anyway [8,9].

## CONCLUSIONS

# The technology changes. The scaffolding does not.



**One scaffolding,  
many technologies**

NetLogo, micro:bit, GenCyber platforms, and LLMs each required guided adoption, structured verification, and disciplinary integration.



**Verification is the  
high-leverage stage**

Self-efficacy gains concentrate where educators **learn to audit outputs** which is the task most find most challenging.



**A technology-agnostic model**

Grounded in longitudinal evidence, the progression gives PD designers a replicable framework for whatever comes next.



## REFERENCES

# Published anchors for the decade arc

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# Thank you.

Questions and collaboration welcome.

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