


Chapter 4

Formative Epistemics and Inclusive Design Approach Using Constructive Alignment and Metacognition: Sociotechnical Pedagogy for Computer Education

Ashraf Alam

 <https://orcid.org/0000-0001-6178-1187>

Alliance University, Bengaluru, India

ABSTRACT

This chapter proposes a pedagogy first architecture for computing assessment that couples formative routines with minimalist analytics and equity by design. It argues for alignment to disciplinary big ideas, visible success criteria, short revision cycles, and multimodal evidence including code histories, test rationales, diagrams, and oral defenses. Peer and self-judgment are cultivated as disciplined practices, supported by universal design and culturally sustaining tasks. Analytics remain small, interpretable, and privacy preserving, answering concrete instructional questions within hours. Capacity is built through coaching, lesson study, micro credentials, and calibrated observation, with change managed through protected schedules and toolkits. Comparative cases from K to 8, secondary, undergraduate, and reskilling contexts show feasibility and impact. An improvement science agenda links logic models to measurable gains in competence, fairness, and credible external signaling.

DOI: 10.4018/979-8-3373-6546-6.ch004

Copyright © 2026, IGI Global Scientific Publishing. Copying or distributing in print or electronic forms without written permission of IGI Global Scientific Publishing is prohibited. Use of this chapter to train generative artificial intelligence (AI) technologies is expressly prohibited. The publisher reserves all rights to license its use for generative AI training and machine learning model development.

INTRODUCTION

Computer science education often valorizes syntax recall, isolated correctness, and speeded quizzes while contemporary software practice prizes underdetermined problem framing, systematic debugging, evidentiary testing, literate documentation, and collaborative governance (Yue et al., 2022). The resulting construct misalignment distorts study behaviors and grading heuristics, privileging brittle performance over transferable competence (Susanto et al., 2020). Convergent evidence shows that learning trajectories steepen when teachers elicit and act on in-course evidence rather than tally end states, that high yield feedback is timely, specific, and task or process oriented, and that mastery learning treats time as elastic and quality as invariant (Tzafilkou et al., 2023). Strong effects accrue when success criteria are public, revision is routine, and design rationales are examinable. In programming this means criteria for decomposition, naming, invariants, test coverage, and ethical data use, accompanied by staged submissions and brief oral defenses. The chapter advances an integrated architecture in which assessment for learning, inclusion by design, and interpretable analytics operate as a single cybernetic system that stabilizes measurement validity, accelerates remediation, and renders intermediate reasoning inspectable (Dai et al., 2024).

The chapter functions as a narrative synthesis across learning sciences, computing education, human computer interaction, program evaluation, organizational change, and information law, translating theory into deployable routines for classrooms, departments, and systems (Choi et al., 2023). Instructors receive design patterns such as visible criteria, peer and self-calibration with anchor exemplars, and guaranteed resubmission windows that credit growth. Leaders receive schedule and incentive blueprints that protect critique, moderation, and double marking. Policymakers receive implementable guardrails that normalize formative use of data while honoring privacy by design, with consent, minimization, role bounded access, auditability, and retention limits aligned with statutory regimes whose enforceability for European general data protection began in 2018 alongside longstanding frameworks such as FERPA and COPPA and recent national statutes (Papadakis, 2022). Students and industry partners receive a portfolio logic that foregrounds code with history, test rationales, design tradeoffs, and reflective narratives that better index reliability, maintainability, and collaborative judgment than isolated scores.

Analytics is positioned as an attentional prosthesis for pedagogy rather than as an oracle (Fagerlund et al., 2021). Signals are proportional to the instructional question, interpretable in a brief conference, and paired with candidate teacher moves to close a sense make act loop. A three-item exit probe on loop invariants often outperforms exhaustive telemetry, and a spike in compile failures warrants different action depending on whether the goal is conceptual consolidation, pro-

32 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/formative-epistemics-and-inclusive-design-approach-using-constructive-alignment-and-metacognition/403729

Related Content

A Poetic Reflective Essay Conceptualizing a Case for Diversity, Equity, and Inclusion in Higher Education: Spirit of Care, Not Spirit Murder

Lisa Merriweather, Viktor Wang, Torie C. Wheatley and Cynthia Stone (2024). *International Journal of Technology-Enhanced Education* (pp. 1-16).

www.irma-international.org/article/a-poetic-reflective-essay-conceptualizing-a-case-for-diversity-equity-and-inclusion-in-higher-education/358749

Teaching Offensive Lab Skills: How to Make It Worth the Risk?

Zouheir Trabelsi, Margaret McCoe and Yang Wang (2020). *Handbook of Research on Diverse Teaching Strategies for the Technology-Rich Classroom* (pp. 138-152).

www.irma-international.org/chapter/teaching-offensive-lab-skills/234253

Robotics as a Powerful Vehicle Toward Learning and Computational Thinking in Secondary Education of 21st Century

Katerina V. Glezou (2022). *Research Anthology on Computational Thinking, Programming, and Robotics in the Classroom* (pp. 716-755).

www.irma-international.org/chapter/robotics-as-a-powerful-vehicle-toward-learning-and-computational-thinking-in-secondary-education-of-21st-century/287362

Teaching Preferences of International Students: A Review of STEM and Non-STEM Student Perspectives

Clayton Smith, George Zhou, Michael Potter, Deena Wang, Fabiana Menezes, Gagneet Kaur and Gabriela Danko (2021). *International Journal of Technology-Enabled Student Support Services* (pp. 37-55).

www.irma-international.org/article/teaching-preferences-of-international-students/308463

Current and Emerging Tools for Flexible Remote Learning

Sapha Mosawy (2018). *Emerging Technologies and Work-Integrated Learning Experiences in Allied Health Education* (pp. 106-125).

www.irma-international.org/chapter/current-and-emerging-tools-for-flexible-remote-learning/195972