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# Bridging Theory and Practice: A Hybrid Model for Electrical Engineering Technology Education Using Alternating Onsite and Online Labs

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# Bridging Theory and Practice: A Hybrid Model for Electrical Engineering Technology Education Using Alternating Onsite and Online Labs

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**Abstract**

Electrical Engineering Technology (EET) programs increasingly serve adult and working learners who require scheduling flexibility while still needing rigorous hands-on laboratory preparation. This paper presents a design and implementation framework for a hybrid Applied Electronics course scheduled for pilot delivery in 2026. The model uses a structured two-week alternating cadence: Week A is an asynchronous online preparation week built around guided circuit simulation, prediction, parameter exploration, and readiness artifacts; Week B is an extended onsite laboratory week focused on instrumentation, measurement, prototyping, teamwork, troubleshooting, and technical reporting. The contribution is not the use of hybrid delivery alone, but the intentional sequencing of simulation as a required preparation mechanism that produces evidence used directly in the following physical lab. The framework is grounded in adult learning, experiential learning, and laboratory education literature, and it maps course activities to ABET ETAC baccalaureate outcomes related to applied problem solving, experimentation and interpretation, modern tool use, communication, and teamwork. Because the course has not yet been piloted, the paper does not report learning outcomes. Instead, it specifies success criteria and an evaluation plan that includes readiness quizzes, rubric-scored integrated lab reports, practical skills checks, troubleshooting tasks, student feedback, completion and persistence indicators, and contextual comparison with prior traditional course offerings. The paper also discusses scalability for larger enrollments, resource-constrained laboratories, asynchronous engagement strategies, and consistency mechanisms for evaluating practical skills across students and lab sections.

Keywords: Hybrid learning; electrical engineering technology; laboratory education; adult learners; simulation-based preparation; ABET ETAC; workforce readiness.

## 1. Introduction

Laboratory education is central to engineering and engineering technology because it gives students opportunities to connect theoretical models with physical behavior through measurement, uncertainty, failure, and iteration [2]. In Electrical Engineering Technology programs, laboratory work is not a peripheral supplement to lecture. It is where students develop applied competencies such as safe instrument operation, wiring discipline, troubleshooting, data interpretation, and technical documentation. These competencies are closely aligned with technologist roles in industry and with ABET ETAC expectations for baccalaureate engineering technology programs [1], [2].

At the same time, EET programs increasingly serve adult learners, working students, and students with significant time and travel constraints. Adult learning theory suggests that these learners benefit from self-direction, immediate relevance, problem-centered tasks, and opportunities to connect new learning with prior experience [5], [6]. Weekly fixed-schedule laboratories can create access barriers for these students, especially when campus attendance must be coordinated with employment, family obligations, or military service. Programs therefore face a persistent design challenge: how to expand flexibility without weakening the hands-on rigor that defines engineering technology education.

This paper addresses that challenge by presenting a hybrid laboratory framework for an Applied Electronics course scheduled for pilot implementation in 2026. The manuscript is intentionally framed as a design and implementation study rather than as an outcomes study. Since the course has not yet run, the paper does not claim measured learning gains. Instead, it describes the course architecture, theoretical rationale, ABET ETAC alignment, implementation requirements, success criteria, and planned evaluation strategy. The target audience is EET faculty, program directors, and curriculum leaders seeking practical models for balancing adult learner flexibility with laboratory authenticity.

The novelty of the proposed model is not simply that the course is hybrid. Hybrid, remote, and simulation-supported laboratories are already represented in the literature [3], [4], [15], [16], [19], [20]. The contribution is a structured alternating two-week cadence in which asynchronous simulation is not treated as a substitute for hands-on work, nor as a loosely connected pre-lab exercise. Instead, online simulation is a required preparation phase that produces specific readiness artifacts, predictions, annotated plots, and hypotheses that are then tested during the following onsite laboratory session. The model intentionally separates prediction, simulation, physical measurement, troubleshooting, and reflection across time while maintaining evidence of ABET ETAC-aligned laboratory competencies.

The paper makes four contributions. First, it defines a replicable alternating online-onsite laboratory cadence for EET applied electronics. Second, it maps the cadence to ABET ETAC baccalaureate student outcomes and workforce-readiness competencies. Third, it provides implementation guidance for access, scheduling, scalability, faculty development, and asynchronous engagement. Fourth, it specifies a prospective assessment and evaluation plan for the 2026 pilot, including how success will be measured and how results will be compared contextually with prior traditional offerings.

## 2. Theoretical Foundations and Related Work

### *2.1 Adult and Experiential Learning*

Adult learning theory provides an appropriate lens for hybrid EET laboratory design because many students bring prior technical experience while facing real constraints on time, travel, and scheduling. Knowles and colleagues emphasize adult learners' needs for self-direction, readiness to learn tasks tied to immediate life roles, and preference for problem-centered activities over content-centered instruction [5]. Merriam's work similarly highlights the importance of context, lived experience, and professional goals in adult learning [6]. Brookfield further emphasizes critical reflection as a mechanism through which adults examine assumptions and learn from experience [7].

The alternating model also draws from experiential learning. Dewey argued that educational experiences must be structured and reflected upon because experience alone does not guarantee learning [8]. Kolb later formalized experiential learning as a cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation [9]. In laboratory education, this suggests that prediction, measurement, reflection, and re-testing should be deliberately designed rather than compressed into a single hurried lab period. The proposed cadence distributes this cycle across online and onsite weeks so that students have time to prepare, act, compare, and reflect.

### *2.2 Hybrid Laboratories and Simulation-Supported Learning*

Blended learning scholarship emphasizes that effective hybrid courses are not simple mixtures of online material and face-to-face time. They require intentional alignment among activities, modalities, outcomes, and assessment [10]. Evidence on web-based instruction also suggests that online learning can be comparable to classroom instruction when instructional design and learning methods are aligned [13]. For laboratory courses, however, design alignment is especially important because different lab modes support different learning objectives.

Research on virtual, remote, and hands-on laboratories indicates that simulations can support conceptual understanding, inquiry, repeatability, and safe exploration of parameter spaces [3], [4]. At the same time, hands-on laboratories expose students to physical non-idealities, equipment limitations, noise, wiring errors, calibration issues, and other conditions that are central to developing experimental judgment [4], [15], [16]. Prior work therefore supports an objective-to-mode alignment approach: simulations are valuable when used for prediction and exploration, while physical labs remain essential for instrumentation competence and troubleshooting.

Guidance is also important. De Jong and van Joolingen note that learners often require prompts, feedback, and structure to learn effectively from simulations [11]. Mayer similarly critiques minimally guided discovery learning in complex domains [12]. In this framework, online simulation activities are therefore scaffolded through prediction prompts, individualized parameters, annotated plots, readiness quizzes, and reflection questions. The intent is to use simulation to improve the quality of onsite laboratory engagement, not to replace the bench experience.

### *2.3 Distinction from Other Hybrid Laboratory Models*

The proposed framework differs from common hybrid laboratory patterns in three ways. First, the online and onsite components are temporally paired in two-week modules so that each online simulation task directly feeds the next onsite build and measurement task. Second, Week A produces required artifacts that become inputs to Week B rather than optional preparation materials. Third, the model assesses the reconciliation of theory, simulation, and measurement through integrated reports and practical skills checks, creating evidence for both conceptual understanding and applied laboratory competence. This structure responds to concerns in the literature that virtual labs may underdevelop practical skills when used in isolation [3], [4], [15], [16].

## 3. The Alternating Two-Week Hybrid Laboratory Framework

### *3.1 Course Context and Design Goals*

The planned pilot is an Applied Electronics course in an EET curriculum and will first run in 2026. The course focuses on analog circuits and measurement practice, including resistive networks, RC transients, operational amplifier behavior, basic filtering, frequency response, and sensor interfacing. As a technology program course, the learning outcomes emphasize applied problem solving, use of modern tools, instrumentation, evidence-based laboratory reporting, and professional communication [1].

The framework was developed around five design goals. The first is integration rather than substitution: simulation supports and amplifies physical laboratory work instead of replacing it. The second is prediction-measurement alignment: Week A requires students to generate predictions that will be tested in Week B. The third is guided simulation: online work includes prompts and checkpoints to avoid unguided exploration. The fourth is measurement-centered onsite time: in-person sessions prioritize instrumentation, troubleshooting, teamwork, and communication. The fifth is outcome-linked evidence: deliverables are structured to support ABET ETAC assessment and continuous improvement.

### *3.2 Core Structure*

Each instructional module spans two weeks. Week A is delivered asynchronously and includes short readings or mini-lectures, worked examples, guided Multisim or browser-based circuit simulation, readiness quizzes, and short reflection prompts. Students submit a readiness artifact that documents analytical predictions, simulation results, annotated plots or screenshots, and a short explanation of expected physical behavior. Week B uses an extended onsite laboratory block, approximately three hours, in which students build the circuit, use bench instruments, collect data, diagnose discrepancies, and participate in team debriefing. Students then submit an integrated report comparing analytical predictions, simulated outputs, and measured results.

This sequence is intended to change how students arrive at the laboratory. Rather than using onsite time to first encounter the circuit, students arrive with a model, a prediction, and an expectation of what should happen. The onsite lab then becomes a higher-value physical investigation of why real circuits behave as expected or deviate from idealized results. The integrated report requires students to reconcile theory, simulation, and measurement rather than treating these as separate assignments.

### *3.3 Week A: Guided Online Preparation*

Week A activities are designed to ensure engagement during asynchronous weeks. Each online module includes a required readiness artifact that must be submitted before the corresponding onsite laboratory. The artifact includes individualized simulation parameters, annotated circuit outputs, brief prediction responses, and a readiness quiz. Instructors can use learning management system completion data, quiz performance, and artifact quality to identify students who are underprepared before the onsite session. Students who do not complete Week A preparation may be required to complete a short onsite readiness check before beginning physical lab work. These requirements make online participation consequential while preserving flexibility for working learners.

The Week A simulation tasks also support academic integrity and active participation. Individualized component values or scenario parameters reduce copying, while reflection prompts require students to explain the meaning of their results in their own words. Examples include predicting the effect of probe loading, estimating the time constant of an RC circuit, identifying where an operational amplifier may saturate, or predicting the cutoff frequency of a filter before performing physical measurements.

### *3.4 Week B: Onsite Measurement and Troubleshooting*

Week B emphasizes the skills that are difficult to develop through simulation alone: safe equipment setup, wiring discipline, instrument configuration, probe compensation, grounding awareness, measurement repeatability, noise interpretation, and systematic troubleshooting. Students work individually or in small teams at lab stations equipped with power supplies, oscilloscopes, multimeters, function generators, breadboards, and standard components. The Week A simulation serves as the blueprint and comparison point for the physical build.

Onsite time is structured around measurement and discrepancy analysis rather than simple procedure following. Students must compare expected and measured values, identify plausible sources of mismatch, and document how they ruled out wiring errors, component tolerances, instrument loading, incorrect oscilloscope settings, or circuit non-idealities. In this way, the model supports workforce readiness by developing evidence-based troubleshooting habits that align with applied EET practice.

### *3.5 Example Module Sequence*

Table 1 illustrates how the same two-week pattern can be applied across several Applied Electronics topics. The table is not intended as a complete syllabus; it demonstrates how online simulation tasks and onsite lab tasks are paired so that students repeatedly practice the same prediction-measurement-reflection cycle in different technical contexts.

**Table 1. Example two-week module pairs for the planned Applied Electronics pilot.**

| Module theme | Week A online focus | Week B onsite focus | Integrated report prompt |
|---|---|---|---|
| Resistive networks and loading | Node/mesh predictions; simulated voltages and currents; parameter variation | Probe loading; wiring errors; tolerance effects; measured voltage/current comparison | Explain mismatches due to loading, tolerance, or measurement setup. |
| RC transients | Time constant prediction; simulation of charge/discharge curves; parameter sweeps | Oscilloscope triggering; ESR/leakage effects; repeatability of transient measurements | Quantify time-constant shift and justify plausible causes. |
| Operational amplifier behavior | Ideal and non-ideal simulation; saturation and slew-rate exploration | Rail limits; bias effects; oscillation; stability and wiring checks | Identify the dominant non-ideality and support the claim with evidence. |
| Filters and frequency response | Bode plot generation; cutoff sensitivity; predicted -3 dB point | Function generator sweep; bandwidth measurement; uncertainty and instrument limits | Compare simulated and measured cutoff frequency and discuss uncertainty. |

## 4. ABET ETAC Alignment and Workforce Readiness

A major purpose of the alternating cadence is to generate evidence that supports ABET ETAC-aligned outcomes while also preserving the workforce relevance of laboratory education. Table 2 maps each major design element to the primary evidence artifact, the relevant outcome area, and the associated workforce-readiness competency. This mapping is intended to help instructors and program leaders see how the model supports assessment rather than treating hybrid delivery as only a scheduling strategy.

**Table 2. Cadence mapping to ABET ETAC-aligned outcomes and workforce competencies.**

| Design element | Primary evidence artifact | ABET ETAC-aligned outcome area | Workforce-readiness emphasis |
|---|---|---|---|
| Week A guided simulation and prediction | Readiness quiz; annotated plots; prediction reflection | Modern tools; applied problem solving; use of technical information | Model-based planning; parameter sensitivity; pre-test hypotheses |
| Week B onsite build and measurement | Observation checklist; measured data; troubleshooting notes | Experimentation; interpretation of results; teamwork | Instrument competence; safety; troubleshooting discipline |
| Integrated theory-simulation-measurement report | Discrepancy analysis; plots; error discussion; conclusions | Communication; engineering judgment; experimentation | Technical reporting; root-cause reasoning; continuous improvement |
| Team debrief and role rotation | Peer/team evaluation; debrief memo; instructor notes | Teamwork; leadership; communication | Handoff communication; collaborative problem solving |

This alignment also clarifies the distinction between conceptual preparation and applied laboratory competence. Week A emphasizes model-based reasoning and modern tool use. Week B emphasizes physical implementation, measurement, safety, and troubleshooting. The integrated report and debrief connect the two modes and require students to communicate technical reasoning in a format similar to workplace documentation.

## 5. Implementation Guidance

### *5.1 Facilities and Access*

Implementation requires bench stations with standard instrumentation, a repeatable parts inventory, and reliable access to simulation tools. Simulation access should prioritize low-friction options such as browser-based tools, virtual desktop infrastructure, or institution-managed licenses. Early technology readiness checks should be completed before the first full module to ensure that students can access the required software and submit simulation evidence.

### *5.2 Scalability and Resource Considerations*

The alternating model can scale by separating activities that require physical bench access from activities that can be completed asynchronously. Larger enrollments can be divided into rotating onsite cohorts while all students complete the same Week A simulation and readiness tasks. When bench capacity is limited, the model can use multiple onsite blocks, paired or team-based lab stations, scheduled open-lab periods, standardized portable breadboard kits, and common lab templates to maintain consistency. The model does not eliminate the need for physical laboratory infrastructure; rather, it concentrates physical lab use into fewer, longer, higher-value sessions focused on measurement and troubleshooting.

Institutions with limited resources can begin with a smaller set of high-impact onsite labs paired with more frequent online simulation activities. For example, one oscilloscope-intensive onsite session may serve multiple online modules if the onsite task is designed to test several prior predictions. Programs can also scale through faculty calibration, common rubrics, shared simulation templates, and standardized checklists that reduce variation across lab sections.

### *5.3 Faculty Development and Consistency*

Effective hybrid labs depend on faculty skill in both online and onsite facilitation. Faculty preparation should include designing guided simulation prompts, providing feedback on readiness artifacts, facilitating troubleshooting without simply giving students the answer, and scoring practical skills consistently. Rubric calibration sessions are recommended before the pilot and at midterm so instructors and teaching assistants apply observation checklists in comparable ways. This is especially important if the model is scaled across multiple lab sections.

### *5.4 Risk Management and Equity*

The design anticipates common risks: unequal computing access, uneven participation during asynchronous weeks, missed onsite sessions, and variable prior experience with simulation or instrumentation. Mitigations include browser-first software options, short technology onboarding tasks, required readiness artifacts, LMS completion tracking, low-stakes quizzes, limited make-up lab options, and targeted support for students who are underprepared. Equity also requires that students not be penalized simply for having less prior bench experience; practical skills checks should focus on growth, safe performance, and evidence-based reasoning rather than speed alone.

## 6. Assessment and Evaluation Plan

### *6.1 Success Criteria and Comparison to Traditional Offerings*

Because the pilot will occur in 2026, the first evaluation will focus on implementation fidelity, student preparedness, laboratory competence, and student perceptions rather than causal claims. The pilot will be considered successful if students demonstrate comparable or stronger performance than prior traditional sections on laboratory report rubrics, practical instrumentation checks, lab completion rates, and persistence indicators, while also reporting improved scheduling flexibility and perceived preparation for onsite lab work. Comparisons with prior traditional offerings will be used as contextual benchmarks, not as controlled experimental evidence, because cohort differences and instructor effects may influence results.

The evaluation will answer four practical questions: (1) Do Week A simulation and readiness artifacts improve student preparation for Week B onsite labs? (2) Do students attain ABET ETAC-aligned laboratory outcomes at levels comparable to prior traditional offerings? (3) Do adult and working learners perceive improved flexibility without reduced rigor? (4) What implementation friction appears during the first pilot, and what revisions are needed before broader scaling?

### *6.2 Direct and Indirect Evidence*

Direct evidence will include rubric-scored integrated lab reports, readiness quiz scores, practical skills checks, observation checklists, measured data quality, and fault-isolation tasks. Indirect evidence will include mid-semester and end-of-semester survey items on preparedness, workload, flexibility, tool confidence, and perceived workforce relevance. Institutional indicators such as completion rates, attendance patterns, withdrawal rates, and lab grade distributions may be compared with historical traditional sections where comparable data are available.

Analysis will emphasize descriptive statistics and thematic interpretation. Quantitative analysis will examine rubric subscore distributions, readiness quiz performance, lab completion patterns, and practical skills check results. Qualitative analysis will use open-ended survey responses and student reflections to identify themes related to simulation usefulness, onsite lab readiness, schedule flexibility, and barriers to participation. Findings from the first pilot will be used for continuous improvement rather than for broad claims of effectiveness.

### *6.3 Practical Skills and Troubleshooting Evaluation*

Practical skills checks and troubleshooting tasks will be evaluated with common rubrics and checklists to support consistency across students and lab sections. Criteria will include safe power supply setup, correct instrument configuration, probe compensation and grounding, wiring organization, measurement accuracy, documentation of measured values, and ability to explain discrepancies between predicted, simulated, and measured results. Troubleshooting tasks will be scored on hypothesis formation, diagnostic sequence, evidence use, fault correction, and clarity of explanation. Table 3 provides an example rubric structure for these checks.

**Table 3. Example rubric categories for practical skills checks and troubleshooting tasks.**

| Competency area | Observable evidence | Consistent evaluation approach |
|---|---|---|
| Safe setup and instrument use | Correct power supply limits; safe connections; appropriate oscilloscope and multimeter configuration | Checklist scored during onsite work; critical safety errors require immediate correction |
| Measurement accuracy and technique | Measured values within expected tolerance; proper probe grounding; appropriate scale and triggering settings | Rubric compares measurement method, not only final numeric answer |
| Wiring and documentation discipline | Organized circuit layout; labeled data; clear notes on component values and test conditions | Instructor reviews lab notebook, data table, and physical setup |
| Troubleshooting strategy | Clear hypothesis; logical diagnostic sequence; evidence used to eliminate causes | Fault-isolation rubric scored using scenario-based task |
| Discrepancy explanation | Student explains differences among theory, simulation, and measurement using plausible technical causes | Integrated report rubric evaluates reasoning and evidence quality |

### *6.4 Planned Measures*

Table 4 summarizes the planned measures for the 2026 pilot. The table is designed to make the evaluation plan transparent before implementation and to provide a structure that can be reused in subsequent offerings.

**Table 4. Planned measures and analysis approach for the 2026 pilot.**

| Outcome domain | Direct evidence | Indirect evidence | Planned analysis |
|---|---|---|---|
| Experimentation and interpretation | Rubric-scored integrated reports; practical skills checks | Confidence and preparedness survey items | Descriptive statistics; rubric subscore trends over modules |

| Outcome domain | Direct evidence | Indirect evidence | Planned analysis |
| --- | --- | --- | --- |
| Instrumentation and troubleshooting | Onsite observation checklist; fault-isolation task | Reflection prompts on barriers and strategies | Error taxonomy; thematic coding of troubleshooting narratives |
| Communication | Report rubric; brief oral or written debrief artifact | Student feedback on clarity and workload | Inter-rater calibration; longitudinal improvement across reports |
| Teamwork | Peer evaluation; instructor observation notes | Team climate or collaboration items | Triangulation across peer, instructor, and artifact evidence |
| Persistence and access | Completion rates; lab attendance; withdrawals; missed lab patterns | Adult learner scheduling and flexibility survey items | Contextual comparison to historical traditional sections |

## 7. Discussion

The proposed model addresses several common challenges in hybrid laboratory design: maintaining hands-on rigor, supporting adult learner flexibility, aligning simulation with physical measurement, and generating evidence for ABET ETAC outcomes. Its primary design argument is that simulation is most valuable when it prepares students for higher-quality physical laboratory work. In this model, the asynchronous week is not a convenience layer; it is an evidence-generating preparation phase that structures the subsequent onsite experience.

The model also acknowledges an important limitation: without pilot data, effectiveness cannot yet be claimed. The paper therefore contributes a replicable design and evaluation plan rather than outcome results. This distinction is important because early implementation studies can still be valuable to ASEE audiences when they provide concrete structures, assessment plans, and transferability guidance. The planned 2026 pilot will provide evidence about implementation fidelity, student readiness, practical skill development, and student perceptions of flexibility and rigor.

Scalability will depend on local resources. Programs with strong laboratory infrastructure may use the model to reduce weekly travel burden while preserving meaningful bench time. Programs with limited resources may adopt a smaller number of onsite measurement-intensive sessions paired with more online preparation. In either case, the model requires careful faculty development, consistent rubrics, and a clear policy for asynchronous engagement and missed onsite work. The design is therefore best understood as a structured framework that can be adapted, not as a one-size-fits-all course package.

## 8. Conclusion and Future Work

This paper presented a hybrid Applied Electronics laboratory framework for EET programs serving adult and working learners. The alternating two-week cadence links guided online simulation and prediction work with extended onsite laboratory sessions focused on instrumentation, measurement, troubleshooting, teamwork, and evidence-based reporting. The framework is grounded in adult learning theory, experiential learning, blended learning research, and laboratory education literature, and it is aligned with ABET ETAC baccalaureate outcome areas related to applied problem solving, experimentation, modern tool use, communication, and teamwork.

Because the course has not yet been piloted, the contribution is a design and implementation blueprint rather than a report of results. Future work will implement the course in 2026, collect the planned evidence, compare key indicators with prior traditional offerings where feasible, and refine the model based on readiness, performance, student feedback, and implementation challenges. Later studies may evaluate whether the alternating cadence can be scaled across additional EET laboratory courses and across institutions with different enrollment patterns and laboratory resources.

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## Appendix A. Planned Outcome Measures and Instruments

Table A1 provides a more detailed view of the planned outcome measures and instruments. The appendix is included to make the assessment plan reusable while keeping the main narrative focused.

**Table A1. Outcome measures and instruments for the alternating hybrid laboratory model.**

| Outcome domain | What is measured | Instrument or indicator | Collection frequency | Notes on interpretation |
|---|---|---|---|---|
| Online preparation | Completion and quality of Week A readiness work | Readiness quiz; annotated simulation artifact; LMS completion data | Every online week | Used to identify students needing support before onsite lab. |
| Theory-simulation-measurement integration | Ability to reconcile calculations, simulation outputs, and measured data | Integrated lab report rubric | Every module | Focuses on reasoning and evidence, not only correct final values. |
| Instrumentation competence | Safe and correct use of bench instruments | Practical skills checklist | Selected onsite labs | Critical safety behaviors must be demonstrated consistently. |
| Troubleshooting discipline | Ability to form hypotheses, test causes, and correct faults | Fault-isolation task rubric | Midterm and final lab period | Evaluates process and explanation as well as solution. |

| Outcome domain | What is measured | Instrument or indicator | Collection frequency | Notes on interpretation |
|---|---|---|---|---|
| Communication | Clarity of written and graphical technical reporting | Report rubric; debrief memo or short presentation | Every module or selected modules | Tracks improvement in data presentation and technical justification. |
| Teamwork and collaboration | Role participation, peer support, and lab communication | Peer evaluation; instructor observation notes | Midterm and end of course | Interpreted alongside team role assignments and attendance. |
| Flexibility and access | Student perceptions of schedule, workload, and barriers | Mid-semester and end-of-semester surveys | Twice per course | Used to refine cadence, workload, and support structures. |
| Persistence and completion | Attendance, withdrawals, lab completion, and course completion | Institutional course data | End of course | Compared contextually with prior traditional sections, not treated as causal proof. |