Engineering Trustworthy Intelligent Systems

ETIS Classroom Facilitation Guide

Running ETIS Learning Environments

Software Engineering, Governance, and Operational Trust in the AI Era

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FIRST EDITION EDUCATIONAL PRODUCT

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Copyright and Use

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ETIS educational products are intended for professional and educational use. They are not substitutes for institutional policy, legal advice, regulatory review, academic governance, or professional judgment.

ETIS Educational Product Series

This document is part of the **ETIS Educational Product Series**.

The educational product series transforms *Engineering Trustworthy Intelligent Systems* from a publication into a teachable, adoptable, and stewardable engineering framework.

The series is designed for instructors, students, departments, universities, professional educators, and institutions adopting ETIS in software engineering, AI governance, responsible AI, enterprise systems, capstone, project-based, or professional-practice environments.

Product Family

The ETIS Educational Product Series includes:

Product	Primary Purpose
ETIS Educational Ecosystem Guide	Explain the full ETIS educational architecture and public product model
ETIS Instructor Course Package	Provide the instructor operating system for course design and delivery
ETIS Classroom Facilitation Guide	Help instructors run ETIS classrooms as active engineering environments
ETIS Instructor Handbook	Preserve instructor guidance, teaching judgment, and long-term stewardship practices
ETIS Student Professional Engineering Guide	Help students understand and practice professional engineering behaviors

Relationship to the ETIS Book

The ETIS book remains the authoritative doctrine.

The educational product series translates that doctrine into teaching, learning, adoption, classroom operation, and stewardship resources.

Educational products teach ETIS.

Adoption examples prove ETIS.

Educational stewardship sustains ETIS over time.

Common Educational Premise

ETIS education is built on a simple premise:

> AI can produce artifacts. Engineers create trust.

Students should not merely complete assignments.

They should develop evidence of engineering maturity.

Instructors should not merely deliver content.

They should operate educational systems that help students practice trustworthy engineering.

Shared Educational Mission

ETIS educational products teach future engineers to:

- define intent
- engineer context
- bound authority
- verify behavior
- operate reality
- explain decisions
- own outcomes

Use of This Product

This product is intended to be used as a public educational resource.

It should be read together with the ETIS book, appendices, educational ecosystem pages, instructor resources, student resources, flagship implementation guidance, and institutional adoption guidance.

ETIS Classroom Facilitation Guide

Who This Is For

This guide is for instructors actively running ETIS classroom experiences.

It is especially useful for:

- course instructors
- teaching assistants
- graduate team leads
- capstone coordinators
- review-board facilitators
- faculty piloting ETIS

Purpose

The Classroom Facilitation Guide helps instructors run an ETIS course as an active engineering environment.

It focuses on what instructors do during the semester: framing discussions, managing reviews, guiding teams, facilitating AI responsibility, preparing release defenses, and helping students mature as engineers.

Classroom Operating Philosophy

An ETIS classroom should feel like a small professional engineering organization.

Students should not simply ask:

> What do we need to submit?

They should learn to ask:

> What evidence proves this engineering work is responsible, reviewable, and ready?

The classroom should continuously reinforce professional engineering behavior.

Instructor Role

The instructor acts as:

- educator
- engineering coach
- review facilitator
- governance challenger
- evidence reviewer
- release-readiness examiner
- steward of educational memory

The instructor should not solve the project for students.

The instructor should help students see what accountable engineering requires.

Running the Semester

A semester should move through predictable phases:

Orientation ↓ Team Formation ↓ Repository Setup ↓ Requirements and Planning ↓ Architecture and Review ↓ Construction and Verification ↓ Cycle 1 Release Defense ↓ Operational Maturity Work ↓ Final Release Defense ↓ Reflection and Stewardship

Each phase should increase the level of engineering accountability.

Facilitating Teams

Teams need clear expectations.

Facilitation should emphasize:

- role clarity
- shared repository ownership
- communication norms
- visible work
- documented decisions
- honest status
- evidence-based progress
- peer accountability

When teams struggle, the instructor should ask evidence-centered questions:

- What is unclear?
- Where is the decision recorded?
- What does the repository show?
- Who owns the next action?
- What risk is being carried?
- What evidence would convince a reviewer?

Facilitating AI Responsibility

AI should be treated as an engineering participant whose output requires governance.

Classroom discussions should reinforce:

- AI may assist
- AI does not own outcomes
- meaningful AI use must be disclosed
- AI outputs must be verified
- students must understand submitted work
- hidden dependency is an engineering risk

Useful classroom questions include:

- What did AI propose?
- What did the team accept?
- What did the team reject?
- How was the output verified?
- What evidence was preserved?
- Can the team defend the result?

Facilitating Reviews

Reviews should be treated as normal engineering activity.

Common review types include:

- requirements review
- architecture review
- design review
- AI-use review
- pull request review
- testing evidence review
- release-readiness review
- operational-readiness review
- final engineering defense

Reviews should challenge the evidence, not merely the presentation.

Review-Board Facilitation

When running review-board activities, the instructor should focus on:

- clarity of decision
- strength of evidence
- remaining risks
- known limitations
- AI assistance
- verification quality
- operational readiness
- ownership of follow-up actions

A good review should leave the team with sharper engineering judgment.

Managing Milestones

Milestones should prevent end-of-semester compression.

Facilitation should make clear that each milestone is a phase gate.

Students should know:

- what evidence is expected
- what questions will be asked
- what decisions must be defended
- what risks must be surfaced
- what repository artifacts should exist

Milestones should mature the project and the team.

Running Release Defenses

Release defense is one of the most important ETIS classroom activities.

A release defense should answer:

- What was built?
- What requirements does it satisfy?

- What evidence supports release readiness?
- What tests were run?
- What defects or limitations remain?
- What AI assistance was used?
- How was AI-assisted work verified?
- What operational risks remain?
- What would need to improve before real deployment?

A demo alone is not enough.

A release must be defended with evidence.

Classroom Discussion Prompts

Useful ETIS classroom prompts include:

- What decision did you make, and where is the evidence?
- What would a reviewer challenge?
- What did AI help with?
- What did the team verify?
- What assumption worries you most?
- What is the release risk?
- What operational issue would appear first?
- What would you do differently next cycle?

These prompts develop engineering judgment.

Managing Student Maturity

Students may initially think ETIS is documentation-heavy.

Facilitation should help them understand that evidence is not paperwork.

Evidence is what makes engineering work reviewable.

The instructor should repeatedly connect artifacts to professional purposes:

- requirements preserve intent
- ADRs preserve decisions
- reviews preserve accountability
- tests preserve verification
- AI logs preserve transparency
- release records preserve judgment
- postmortems preserve learning

Semester Closeout

The closeout should preserve learning.

Instructors should collect:

- student reflections
- team lessons learned
- repository quality observations
- assignment improvement notes
- AI-use observations

- review-board lessons
- assessment calibration notes

Every semester should improve the next semester.

How To Use This Resource

Use this guide during active course delivery.

It should help instructors:

- guide classroom conversations
- manage teams
- run reviews
- facilitate AI responsibility
- structure release defenses
- respond to student confusion
- preserve educational memory

Relationship to Other ETIS Products

Use this guide with:

- the Instructor Course Package for course architecture
- the Instructor Handbook for long-term teaching judgment
- the Student Professional Engineering Guide for student expectations
- the Educational Ecosystem Guide for public educational context

Bottom Line

An ETIS classroom should produce more than working software.

It should produce students who can explain, review, verify, govern, operate, and defend engineering work.

Facilitation is how that transformation becomes visible.

Part I

Classroom Operating Model

Facilitation Philosophy

Purpose

ETIS classroom facilitation is the practice of operating educational environments that progressively transform students into trustworthy engineers.

This document establishes the philosophy that governs how ETIS educational experiences should be conducted.

This is not a teaching methodology.

This is an educational operations philosophy.

Software engineering education is no longer solely about transmitting knowledge.

It is about creating engineering environments where students progressively assume responsibility for building, reviewing, defending, operating, and stewarding intelligent systems.

Educational work should resemble professional engineering work.

Students should not experience disconnected academic activities.

Students should experience engineering ecosystems.

Core Question

This document answers:

> How should instructors think about operating ETIS classroom experiences?

Foundational Belief

Students do not become trustworthy engineers by consuming information.

Students become trustworthy engineers by repeatedly participating in trustworthy engineering behaviors.

Educational experiences should intentionally create those behaviors.

Trustworthy engineers are formed through repetition, accountability, reflection, and ownership.

Educational systems should deliberately engineer those experiences.

The Instructor Is An Educational Operator

ETIS instructors are not information distributors.

ETIS instructors are educational operators.

Their responsibility is to design and operate environments where engineering behaviors naturally emerge.

The instructor continuously balances:

- structure
- autonomy
- accountability
- ownership
- review
- reflection
- operational thinking

The instructor gradually decreases control as students progressively increase responsibility.

Educational Work Should Resemble Professional Engineering Work

This is one of the foundational ETIS educational principles.

Educational activities should increasingly resemble real engineering activities.

Students should:

- define objectives
- make decisions
- create artifacts
- defend decisions
- review peers
- evaluate evidence
- operate systems
- communicate uncertainty
- manage AI usage
- own outcomes

Artificial academic exercises should be minimized.

Authentic engineering experiences should be maximized.

Educational Systems Should Produce Engineering Behaviors

Educational success should not be measured by content coverage.

Educational success should be measured by behavioral transformation.

The question is not:

> What did students learn?

The question becomes:

> What engineering behaviors did students repeatedly demonstrate?

Desired behaviors include:

- evidence production
- engineering accountability
- engineering communication
- responsible AI usage
- peer review
- engineering defense
- operational thinking
- ownership

Behaviors ultimately become habits.

Habits ultimately become professional identity.

The Classroom Is An Engineering Ecosystem

ETIS classrooms should not function as lecture delivery systems.

ETIS classrooms should function as engineering ecosystems.

Every classroom activity should contribute to a larger system.

Students should understand:

- why activities occur
- how activities connect
- what artifacts they produce
- how evidence accumulates
- how engineering decisions evolve over time

Disconnected activities should be avoided.

System thinking should be reinforced continuously.

Progressive Responsibility Model

Responsibility should increase throughout the course.

The classroom should gradually shift ownership from instructor to students.

Instructor Ownership

↓

Shared Ownership

↓

Engineering Team Ownership

↓

Student Ownership

↓

Review Ownership

↓

Operational Ownership

↓

Professional Ownership

The ultimate goal is to make the instructor progressively less central.

Students should increasingly become self-governing engineers.

Facilitate Transformation, Not Completion

Assignment completion is not the educational objective.

Transformation is the educational objective.

Activities should intentionally move students through the ETIS transformation pathway.

Student

↓

Responsible Engineer

↓

Reviewer

↓

Architect

↓

Release Defender

↓

Operational Thinker

↓

Future Trustworthy Engineer

Every educational experience should move students further along this pathway.

AI Is An Engineering Reality

AI is not an exception.

AI is not a disruption.

AI is an engineering reality.

Students should continuously learn how to:

- disclose AI usage
- verify AI outputs
- challenge AI conclusions
- bound AI authority
- engineer AI context
- identify AI risks

AI responsibility should become habitual engineering behavior.

Educational systems should normalize responsible AI usage.

Educational systems should never normalize AI dependency.

Engineering Work Is Not Complete Until It Can Be Defended

This principle should appear continuously throughout classroom experiences.

Students should expect to answer questions such as:

- Why did you do this?
- What evidence supports this?
- What alternatives were considered?
- What assumptions were made?
- What risks remain?
- How was AI used?
- What would you do differently?

Engineering defense should become routine.

Students should become comfortable defending uncertainty.

Operate Reality, Not Perfection

Students should learn that engineering occurs under constraints.

Real systems are:

- imperfect
- incomplete
- evolving
- uncertain

Educational experiences should reflect those realities.

Students should learn to operate ambiguity rather than avoid ambiguity.

Students should become comfortable making responsible decisions with incomplete information.

Facilitation Principles

Every ETIS classroom experience should be:

Intentional Every activity exists for a reason.

Authentic Educational work resembles professional engineering work.

Evidence Driven Artifacts create evidence.

Review Oriented Engineering work should be reviewed.

Operational Students should think beyond implementation.

Reflective Students should explain their decisions.

Responsible Students should own outcomes.

Educational Maturity Should Mirror Engineering Maturity

As courses mature, educational systems should evolve accordingly.

Early stages may emphasize:

- understanding
- exposure
- guidance

Later stages should emphasize:

- ownership
- accountability
- review
- defense
- operation

Complexity may scale.

Accountability should not.

This principle remains foundational.

> Scale complexity, not accountability.

Constitutional Educational Pillars

These principles should remain stable over time.

- Educational work should resemble professional engineering work.
- Engineering accountability is the educational outcome, not the side effect.
- Engineering work is not complete until it can be defended.
- AI usage is not an academic violation. Undisclosed and unverified AI dependency is an engineering risk.
- Do not assess AI avoidance. Assess AI responsibility.
- Evidence maturity should mirror engineering maturity.
- Assessment maturity should mirror engineering maturity.
- Scale complexity, not accountability.
- Scale evaluation mechanisms, not engineering expectations.

Long-Term Stewardship

Future educators should inherit operational philosophies rather than create facilitation approaches from scratch.

The objective is not to create engaging classes.

The objective is to engineer trustworthy engineers.

Facilitation Models Library

Purpose

This document establishes reusable facilitation models that instructors can assemble to build ETIS classroom experiences.

Educational environments should be engineered, not improvised.

This library provides repeatable operational patterns that instructors can use throughout a course.

These models intentionally resemble engineering systems rather than traditional teaching techniques.

The purpose is not to increase classroom engagement.

The purpose is to create repeatable engineering transformation experiences.

Core Question

This document answers:

> What reusable facilitation models can instructors use to operate ETIS classroom experiences?

Educational Operations Philosophy

Facilitation should not rely upon instructor personality.

Facilitation should rely upon repeatable systems.

Educational systems should be:

- reusable
- adaptable
- scalable
- explainable
- governable

Instructors should inherit facilitation systems instead of inventing classroom experiences each semester.

Facilitation Model Categories

The facilitation models intentionally support increasing levels of engineering maturity.

Information Models

↓

Decision Models

↓

Evidence Models

↓

Review Models

↓

Defense Models

↓

Operational Models

↓

Stewardship Models

Students progressively assume more engineering responsibility.

Model 1: Guided Engineering Conversation

Purpose

Move students from passive listeners to active engineering thinkers.

Instructor Role

Guide the conversation.

Do not provide immediate answers.

Student Responsibilities

Students should:

- identify assumptions
- identify risks
- identify alternatives
- explain reasoning

Example Questions

- Why would this work?
- Why might this fail?
- What assumptions are being made?
- What evidence supports this?
- What information is missing?

Best Used For

- introducing concepts
- architecture discussions
- AI discussions
- risk analysis

Model 2: Artifact-Centered Facilitation

Purpose

Center classroom experiences around engineering artifacts.

Students discuss work products rather than opinions.

Artifacts may include:

- requirements
- architectures
- ADRs
- diagrams

- AI outputs
- release evidence

Student Responsibilities

Students should:

- explain artifacts
- critique artifacts
- improve artifacts
- defend artifacts

Best Used For

- design sessions
- peer reviews
- engineering defenses

Model 3: Engineering Decision Facilitation

Purpose

Teach students how engineering decisions are made.

Every engineering decision should answer:

- What problem exists?
- What options exist?
- Why was this chosen?
- What risks remain?

Best Used For

- architecture decisions
- technology selection
- AI usage decisions

Model 4: Evidence Construction Facilitation

Purpose

Teach students how evidence accumulates.

Students should continuously answer:

- What evidence exists?
- Is it sufficient?
- What evidence is missing?
- How trustworthy is the evidence?

Best Used For

- testing discussions
- quality assurance
- release readiness

Model 5: Peer Review Facilitation

Purpose

Normalize engineering review.

Students should review engineering work rather than individuals.

Review discussions should focus on:

- evidence quality
- assumptions
- risks
- clarity
- completeness

Best Used For

- pull request reviews
- architecture reviews
- assignment reviews

Model 6: Engineering Defense Facilitation

Purpose

Normalize engineering accountability.

Students defend decisions rather than present information.

Core questions:

- Why?
- How?
- What evidence exists?
- What risks remain?
- What alternatives were considered?

Best Used For

- milestone reviews
- presentations
- demonstrations

Model 7: AI Verification Facilitation

Purpose

Teach responsible AI usage.

Students should answer:

- What AI was used?
- What was delegated?
- What was verified?
- What was changed?
- What risks remain?

AI disclosure should become routine.

Best Used For

- coding exercises
- architecture exercises
- documentation activities

Model 8: Operational Thinking Facilitation

Purpose

Teach students to think beyond implementation.

Students should continuously ask:

- How will this operate?
- How will this be monitored?
- How will failures be detected?
- How will issues be resolved?

Best Used For

- operations discussions
- incident scenarios
- observability exercises

Model 9: Review Board Facilitation

Purpose

Simulate professional engineering governance.

Students should defend engineering work before reviewers.

Reviewers should challenge:

- evidence
- assumptions
- risks
- AI usage
- operational readiness

Best Used For

- capstones
- milestone reviews
- release defenses

Model 10: Reflection Facilitation

Purpose

Normalize engineering learning.

Students should answer:

- What changed?

- What surprised you?
- What failed?
- What would you improve?
- What would you repeat?

Reflection should become an engineering habit.

Best Used For

- retrospectives
- postmortems
- course milestones

Progressive Facilitation Maturity Model

Courses should gradually evolve through increasing maturity.

Instructor Explains
↓
Instructor Guides
↓
Students Collaborate
↓
Students Review
↓
Students Defend
↓
Students Operate
↓
Students Steward

The instructor gradually becomes less central.

Students gradually become engineers.

Model Selection Guidance

Different educational stages should emphasize different models.

Early Course Primary Models:

- Guided Engineering Conversation
- Artifact-Centered Facilitation
- Engineering Decision Facilitation

Middle Course Primary Models:

- Evidence Construction Facilitation
- Peer Review Facilitation
- AI Verification Facilitation

Late Course Primary Models:

- Engineering Defense Facilitation
- Operational Thinking Facilitation
- Review Board Facilitation
- Reflection Facilitation

Relationship To Other Educational Engines

This library operationalizes previous engines.

Educational Intent

↓

Educational Sequencing

↓

Educational Accountability

↓

Educational Evaluation

↓

Educational Operations

Facilitation activates all previous systems.

Long-Term Stewardship

This library should remain stable.

New models may be added over time.

However, models should remain reusable, repeatable, and institution agnostic.

Future educators should inherit facilitation systems rather than invent classroom experiences from scratch.

The goal is not better lectures.

The goal is trustworthy engineer formation.

Session Assembly Guide

Purpose

This document provides a repeatable process for assembling ETIS classroom sessions.

Class sessions should be engineered, not planned.

ETIS sessions are intentionally designed to resemble engineering environments rather than traditional lectures.

The objective is not to maximize information delivery.

The objective is to maximize engineering transformation.

Every session should intentionally move students further along the ETIS professional transformation pathway.

Core Question

This document answers:

> How do instructors assemble ETIS classroom experiences?

Educational Operations Philosophy

A classroom session is an operational unit.

Every session should have:

- intent
- activities
- artifacts
- evidence
- reflection

Sessions should never be isolated experiences.

Each session should connect to prior sessions and contribute to future sessions.

Students should experience educational continuity.

ETIS Session Architecture

Every session should contain five components.

Intent

↓

Experience

↓

Artifact

↓

Evidence

↓

Reflection

Every session should answer five questions.

Component	Question
Intent	Why are we doing this?
Experience	What engineering work will students perform?
Artifact	What will students produce?
Evidence	What engineering accountability will be demonstrated?
Reflection	What did students learn about engineering?

Session Assembly Process

Every session should be assembled in the following order.

1. Define Intent

   ↓

2. Select Facilitation Models

   ↓

3. Design Engineering Experiences

   ↓

4. Identify Artifacts

   ↓

5. Define Evidence Expectations

   ↓

6. Build Reflection Opportunities

Avoid assembling sessions backwards.

Do not begin with slides.

Begin with engineering outcomes.

Step 1: Define Intent

Every session should begin with a single guiding objective.

Ask:

> What engineering behavior should students strengthen today?

Avoid:

> What content will I cover today?

Prefer:

> What engineering capability will students practice today?

Examples:

- engineering decision making
- AI verification

- evidence evaluation
- architectural reasoning
- engineering defense
- operational thinking

Step 2: Select Facilitation Models

Choose one or more facilitation models from the Facilitation Models Library.

Examples:

- Guided Engineering Conversation
- Artifact-Centered Facilitation
- Engineering Decision Facilitation
- Evidence Construction Facilitation
- Peer Review Facilitation
- Engineering Defense Facilitation
- AI Verification Facilitation
- Operational Thinking Facilitation
- Review Board Facilitation
- Reflection Facilitation

Avoid trying to use every model.

Select only those that support the session objective.

Step 3: Design Engineering Experiences

Students should do engineering work.

Avoid sessions dominated by instructor explanation.

Examples include:

- evaluating requirements
- reviewing architectures
- critiquing AI outputs
- reviewing pull requests
- analyzing failures
- defending decisions
- conducting reviews

Students should actively participate.

Passive consumption should be minimized.

Step 4: Identify Artifacts

Every session should produce artifacts whenever possible.

Artifacts create continuity.

Possible artifacts include:

- notes
- diagrams
- ADRs

- review findings
- AI usage disclosures
- risk inventories
- evidence summaries

Artifacts should accumulate over time.

Students should see engineering work evolve.

Step 5: Define Evidence Expectations

Every session should produce evidence.

Students should continuously answer:

- What evidence exists?
- What evidence is missing?
- What evidence supports this decision?
- What evidence supports this conclusion?

Evidence should become routine engineering behavior.

Step 6: Build Reflection Opportunities

Every session should end with reflection.

Students should answer questions such as:

- What changed today?
- What surprised you?
- What assumptions were challenged?
- What risks became visible?
- What engineering behavior improved?

Reflection converts experiences into engineering habits.

Recommended ETIS Session Flow

Most sessions should follow a repeatable pattern.

Context

↓

Discussion

↓

Engineering Work

↓

Review

↓

Reflection

The exact percentages may vary.

However, engineering work should eventually dominate the classroom experience.

Session Time Allocation Model

As courses mature, classroom ownership should shift.

Early Course Instructor Context: 40%

Engineering Activities: 30%

Discussion: 20%

Reflection: 10%

Middle Course Instructor Context: 25%

Engineering Activities: 40%

Discussion: 25%

Reflection: 10%

Late Course Instructor Context: 15%

Engineering Activities: 50%

Review Activities: 25%

Reflection: 10%

Instructor dependence should decrease over time.

Engineering Activity Examples

Requirements Session Activities:

- identify ambiguities
- identify assumptions
- identify risks

Artifact:

- requirements analysis

Evidence:

- identified gaps

Reflection:

- what requirements remain uncertain?

Architecture Session Activities:

- evaluate designs
- compare alternatives

Artifact:

- architecture review findings

Evidence:

- tradeoff analysis

Reflection:

- what risks remain?

AI Session Activities:

- compare AI outputs
- verify AI responses

Artifact:

- AI disclosure record

Evidence:

- verification findings

Reflection:

- where did AI help and where did it fail?

Review Session Activities:

- review peer artifacts

Artifact:

- review findings

Evidence:

- identified issues

Reflection:

- what did reviewing teach you?

Session Quality Checks

Before every session, instructors should verify:

Intent Check Can students explain why this session exists?

Authenticity Check Does this resemble engineering work?

Artifact Check Will something tangible be produced?

Evidence Check Will engineering accountability be demonstrated?

Reflection Check Will students think about their engineering decisions?

If multiple answers are no, redesign the session.

Common Anti-Patterns

Avoid these facilitation failures.

Lecture Saturation Students primarily consume information.

Activity Isolation Activities have no relationship to each other.

Artifact Deficiency Students leave without producing anything.

Accountability Gaps Students are never asked to explain decisions.

Reflection Elimination Sessions end without consolidating learning.

AI Avoidance AI is prohibited rather than responsibly integrated.

Relationship To The ETIS Transformation Model

Every session should move students further along this pathway.

Student
↓
Responsible Engineer
↓
Reviewer
↓
Architect
↓
Release Defender
↓
Operational Thinker
↓
Future Trustworthy Engineer

No session should exist without contributing to transformation.

Long-Term Stewardship

Future educators should inherit session assembly systems rather than invent classroom experiences each semester.

The objective is not creating engaging classes.

The objective is engineering trustworthy engineers.

Part II

Facilitation Practice

Discussion Facilitation Guide

Purpose

This document establishes how instructors should facilitate engineering discussions within ETIS classrooms.

Engineering conversations are engineering artifacts in motion.

Discussions are not participation exercises.

Discussions are engineering work.

Students should learn how engineers collectively evaluate information, challenge assumptions, assess risks, communicate uncertainty, and make responsible decisions.

The objective is not to maximize speaking.

The objective is to maximize engineering thinking.

Core Question

This document answers:

> How should instructors facilitate engineering discussions within ETIS classroom experiences?

Educational Operations Philosophy

Engineering rarely occurs in isolation.

Engineers constantly communicate with:

- peers
- architects
- reviewers
- operators
- stakeholders
- leadership

Students should repeatedly practice those behaviors.

Engineering discussions should intentionally resemble professional engineering conversations.

Educational work should resemble professional engineering work.

Foundational Principle

The purpose of discussions is not to produce answers.

The purpose of discussions is to improve engineering thinking.

Students should become comfortable with:

- ambiguity
- uncertainty
- tradeoffs
- incomplete information
- conflicting viewpoints

Professional engineering rarely has perfect answers.

Students should learn how to navigate uncertainty responsibly.

The Instructor’s Role

The instructor is an educational operator.

The instructor should:

- create context
- guide exploration
- expose assumptions
- surface risks
- encourage evidence usage
- facilitate reasoning

The instructor should not dominate discussions.

The instructor should progressively become less central.

Students should increasingly drive engineering conversations.

Discussion Hierarchy

Engineering discussions should progressively mature over time.

Information Discussion

↓

Reasoning Discussion

↓

Decision Discussion

↓

Evidence Discussion

↓

Review Discussion

↓

Defense Discussion

↓

Operational Discussion

The classroom should progressively shift upward through these levels.

Level 1: Information Discussions

Objective

Build foundational understanding.

Students answer:

- What is this?
- Why does it matter?

- Where is it used?

These discussions should be brief.

Avoid remaining at this level for extended periods.

Level 2: Reasoning Discussions

Objective

Teach engineering thought processes.

Students answer:

- Why would this work?
- Why might this fail?
- What assumptions exist?
- What information is missing?

Reasoning discussions should become common.

Level 3: Decision Discussions

Objective

Teach engineering decision making.

Students answer:

- What options exist?
- Why was this chosen?
- What alternatives were rejected?
- What tradeoffs exist?

Decision making should become habitual.

Level 4: Evidence Discussions

Objective

Teach evidence evaluation.

Students answer:

- What evidence exists?
- Is it sufficient?
- What evidence is missing?
- How trustworthy is the evidence?

Students should learn to separate assumptions from evidence.

Level 5: Review Discussions

Objective

Normalize engineering review.

Students should critique engineering work rather than individuals.

Review discussions should focus on:

- clarity
- completeness
- risks
- assumptions
- evidence quality

Reviews should become routine.

Level 6: Defense Discussions

Objective

Normalize engineering accountability.

Students should defend decisions.

Core questions include:

- Why was this chosen?
- What evidence supports this?
- What risks remain?
- What alternatives exist?
- How was AI used?

Defense should become a normal engineering behavior.

Level 7: Operational Discussions

Objective

Teach systems thinking beyond implementation.

Students should answer:

- How will this operate?
- How will failures be detected?
- How will this evolve?
- How will risks be managed?
- How will users be affected?

Operational thinking should become habitual.

Engineering Discussion Rules

Students should consistently support statements with engineering reasoning.

Move away from:

> I think…

Toward:

> The evidence suggests…

Move away from:

> I prefer…

Toward:

> The tradeoffs indicate…

Move away from:

> It seems fine…

Toward:

> The remaining risks are…

Engineering language should become natural over time.

Instructor Question Framework

Avoid questions that end conversations.

Avoid:

- Is this correct?
- Does everyone understand?
- Any questions?

Prefer questions that expand thinking.

Use:

Assumption Questions

- What assumptions are being made?
- Which assumptions are risky?

Evidence Questions

- What evidence supports this?
- What evidence is missing?

Risk Questions

- What could fail?
- What risks remain?

Alternative Questions

- What other options exist?
- Why was this not selected?

Operational Questions

- How would this operate over time?
- What changes after deployment?

Engineering Silence Is Acceptable

Students should learn to think before speaking.

Silence is not automatically a problem.

Complex engineering questions require reflection.

Avoid immediately answering your own questions.

Allow students time to think.

Professional engineering often requires deliberate thought.

Normalize Productive Disagreement

Disagreement should be encouraged.

Students should challenge ideas professionally.

Students should never attack individuals.

Teach students to say:

- I see a different tradeoff.
- I interpret the evidence differently.
- I have concerns about this assumption.
- I see additional risks.
- I would evaluate another option.

Professional disagreement should become comfortable.

AI Discussion Integration

AI should appear throughout discussions.

Students should routinely answer:

- Was AI used?
- How was AI used?
- What did AI contribute?
- What required human verification?
- What risks did AI introduce?

AI discussions should become ordinary engineering discussions.

Responsible AI usage should become routine.

Discussion Progression Throughout The Semester

Early Course Instructor responsibility:

- establish psychological safety
- teach engineering language
- model engineering thinking

Middle Course Instructor responsibility:

- increase student ownership
- increase review activities
- increase evidence expectations

Late Course Instructor responsibility:

- facilitate defenses
- facilitate reviews
- facilitate operational discussions

Student ownership should continuously increase.

Discussion Quality Checks

Before every discussion ask:

Intent Check Why does this discussion exist?

Authenticity Check Would engineers actually have this conversation?

Evidence Check Will evidence appear?

Accountability Check Will decisions be defended?

Operational Check Will students think beyond implementation?

If multiple answers are no, redesign the discussion.

Common Anti-Patterns

Avoid:

Participation For Participation's Sake Students speak without purpose.

Opinion Dominance Students share preferences without evidence.

Instructor Monologues The instructor answers every question.

Binary Questions Questions that immediately end discussion.

Perfection Seeking Students avoid uncertainty.

AI Avoidance AI is ignored rather than responsibly integrated.

Relationship To The ETIS Transformation Model

Every engineering discussion should move students along this pathway.

Student
↓
Responsible Engineer
↓
Reviewer
↓
Architect
↓
Release Defender

↓

Operational Thinker

↓

Future Trustworthy Engineer

Discussions should intentionally accelerate transformation.

Long-Term Stewardship

Future educators should inherit engineering discussion systems rather than invent facilitation strategies from scratch.

The objective is not increasing classroom participation.

The objective is engineering trustworthy engineers.

Team Facilitation Guide

Purpose

This document establishes how instructors should facilitate team-based engineering experiences within ETIS classrooms.

Teams are not a classroom convenience.

Teams are engineering systems.

Software engineering is inherently collaborative.

Students should repeatedly practice operating within engineering teams before entering professional environments.

The objective is not to create successful student teams.

The objective is to create engineers who can successfully operate within teams.

Educational work should resemble professional engineering work.

Team experiences should intentionally mirror professional engineering environments.

Core Question

This document answers:

> How should instructors facilitate team-based engineering experiences within ETIS classrooms?

Educational Operations Philosophy

Students should not simply complete projects together.

Students should learn how engineering organizations function.

Team facilitation should intentionally teach students how to:

- communicate
- collaborate
- review
- coordinate
- negotiate
- escalate
- defend decisions
- operate uncertainty
- own outcomes

Technical work and team behavior should never be separated.

Professional engineering requires both.

Teams Are Engineering Systems

Teams should be treated as systems rather than collections of individuals.

Every team contains:

- people
- processes
- decisions

- artifacts
- dependencies
- constraints

Students should learn to operate all of them.

Instructors should facilitate systems rather than manage personalities.

The Instructor's Role

The instructor is an educational operator.

The instructor should not become the team's manager.

The instructor should create environments where teams progressively become self-governing.

The instructor should:

- establish structure
- establish accountability
- establish expectations
- facilitate reviews
- expose risks
- encourage reflection

The instructor should avoid becoming the team's decision maker.

Students should increasingly own decisions.

Team Maturity Model

Teams should mature throughout the semester.

Instructor Structured

↓

Instructor Guided

↓

Collaborative Teams

↓

Self-Directed Teams

↓

Review-Oriented Teams

↓

Operational Teams

↓

Engineering Organizations

The instructor should gradually reduce involvement over time.

Team Formation Principles

Teams should intentionally resemble engineering organizations.

Avoid random grouping without purpose.

Teams should balance:

- experience levels
- technical strengths
- communication styles
- backgrounds
- perspectives

Perfect balance is not required.

Learning to operate imperfect teams is part of engineering.

Establish Team Identity Early

Teams should quickly establish:

- team name
- mission
- objectives
- responsibilities
- operating norms

Students should view themselves as engineering teams rather than assignment groups.

Identity strengthens accountability.

Establish Team Operating Agreements

Teams should create lightweight operating agreements.

Possible topics include:

- communication expectations
- meeting frequency
- artifact ownership
- review expectations
- AI usage expectations
- escalation procedures

Operating agreements should be treated as engineering artifacts.

Teams should periodically revisit them.

Team Accountability Should Be Visible

Invisible work creates invisible accountability.

Students should continuously answer:

- Who owns this?
- Who reviewed this?
- Who approved this?

- What remains unfinished?
- What risks remain?

Accountability should be observable.

Team Work Should Produce Artifacts

Team activity should generate engineering artifacts.

Possible artifacts include:

- requirements
- architectures
- ADRs
- review findings
- risk inventories
- evidence records
- AI disclosures

Artifacts create continuity.

Artifacts create accountability.

Artifacts create evidence.

Normalize Engineering Reviews

Review should become routine team behavior.

Teams should regularly review:

- requirements
- architectures
- implementations
- documentation
- AI outputs
- operational readiness

Review should be expected rather than exceptional.

Normalize Engineering Disagreement

Disagreement is healthy.

Students should learn how to professionally disagree.

Students should challenge:

- assumptions
- risks
- evidence
- tradeoffs

Students should not challenge individuals.

Teach students to say:

- I see additional risks.

- I interpret the evidence differently.
- I would evaluate another option.
- I have concerns about this assumption.
- I see different tradeoffs.

Professional disagreement should become comfortable.

Facilitate Team Decision Making

Teams should learn how decisions are made.

Every decision should answer:

- What problem exists?
- What options exist?
- Why was this chosen?
- What risks remain?

Decision quality should be prioritized over decision speed.

Facilitate AI Team Integration

AI should become part of normal engineering operations.

Teams should routinely answer:

- Where was AI used?
- What was delegated?
- What was verified?
- What remains risky?
- What human decisions remain?

AI usage should be transparent.

AI dependency should not become invisible.

Facilitate Escalation Behaviors

Students should learn when to escalate concerns.

Escalation is not failure.

Students should escalate:

- unresolved risks
- missing evidence
- communication breakdowns
- blocked decisions
- unrealistic expectations

Escalation is responsible engineering behavior.

Facilitate Operational Thinking

Teams should think beyond implementation.

Students should routinely answer:

- How will this operate?
- How will this evolve?
- How will failures be detected?
- How will users be affected?
- How will changes be managed?

Operational thinking should become normal.

Team Reflection Should Be Continuous

Teams should periodically ask:

- What is working?
- What is not working?
- What risks are growing?
- What assumptions changed?
- What would we improve?

Reflection should become a team habit.

Team Facilitation Progression Throughout The Semester

Early Course Instructor emphasis:

- establish structure
- establish expectations
- teach accountability

Middle Course Instructor emphasis:

- increase ownership
- increase reviews
- increase decision making

Late Course Instructor emphasis:

- facilitate defenses
- facilitate operations
- facilitate stewardship

Instructor dependence should continuously decrease.

Team Health Indicators

Healthy teams demonstrate:

Shared Ownership Students understand responsibilities.

Visible Accountability Work ownership is clear.

Evidence Generation Artifacts accumulate over time.

Review Behaviors Reviews occur naturally.

Responsible AI Usage AI usage is transparent.

Operational Thinking Students think beyond implementation.

Team Facilitation Quality Checks

Before every team activity ask:

Authenticity Check Would engineers actually work this way?

Accountability Check Can ownership be observed?

Evidence Check Will artifacts be produced?

Review Check Will work be challenged?

Operational Check Will students think beyond implementation?

If multiple answers are no, redesign the activity.

Common Anti-Patterns

Avoid:

Group Project Thinking Students simply divide work.

Hero Engineers One student dominates.

Instructor Dependency Teams wait for instructor decisions.

Invisible AI Usage AI work is undisclosed.

Review Avoidance Students never challenge each other.

Artifact Deficiency Teams create nothing durable.

Last-Minute Integration Teams delay collaboration until deadlines.

Relationship To The ETIS Transformation Model

Every team experience should move students through this progression.

Student

↓

Responsible Engineer

↓

Reviewer

↓

Architect

↓

Release Defender

↓

Operational Thinker

↓

Future Trustworthy Engineer

Team experiences should intentionally accelerate transformation.

Long-Term Stewardship

Future educators should inherit engineering team systems rather than invent team activities every semester.

The objective is not producing successful projects.

The objective is producing engineers who can successfully operate within engineering organizations.

AI Facilitation Guidance

Purpose

This document establishes how instructors should facilitate AI within ETIS classroom experiences.

AI is not a classroom tool.

AI is an engineering participant.

AI should not be treated as an exception, a disruption, or a separate educational topic.

AI is now part of modern engineering reality.

Students should repeatedly practice how to responsibly integrate AI into engineering work.

The objective is not AI proficiency.

The objective is AI stewardship.

Educational work should resemble professional engineering work.

Professional engineering now includes AI.

Educational systems should reflect that reality.

Core Question

This document answers:

> How should instructors facilitate classrooms where AI is an expected engineering participant?

Educational Operations Philosophy

Do not teach students how to use AI.

Teach students how to govern AI.

Students should learn how to:

- engineer AI context
- bound AI authority
- verify AI outputs
- identify AI risks
- disclose AI usage
- own AI outcomes

AI should become a normal engineering reality rather than a special event.

Foundational Principle

AI does not remove engineering responsibility.

AI increases engineering responsibility.

Students should understand:

> Delegation is not ownership.

Humans remain responsible for outcomes.

Ownership never transfers to AI.

AI Is An Engineering Participant

AI should be treated similarly to other engineering participants.

Like any engineering participant, AI has:

Strengths

- speed
- scale
- synthesis
- ideation
- pattern recognition

Weaknesses

- hallucinations
- overconfidence
- inconsistency
- hidden assumptions
- lack of operational accountability

Students should continuously learn to manage both.

The Instructor's Role

The instructor is an educational operator.

The instructor should not become:

- AI police
- AI gatekeepers
- AI prohibition officers

The instructor should create environments where responsible AI usage naturally emerges.

The instructor should continuously reinforce:

- transparency
- verification
- accountability
- ownership

The instructor should normalize AI discussions.

AI Facilitation Maturity Model

Student AI maturity should progressively evolve.

AI Exposure

↓

AI Awareness

↓

AI Verification

↓

AI Governance

↓

AI Accountability

↓

AI Stewardship

Students should continuously move upward through this progression.

Phase 1: AI Exposure

Objective

Normalize AI existence.

Students should understand:

- AI is present
- AI is useful
- AI is imperfect

Avoid fear-based discussions.

Avoid hype-based discussions.

Teach reality.

Phase 2: AI Awareness

Objective

Teach AI limitations.

Students should identify:

- assumptions
- hallucinations
- inconsistencies
- missing information

Students should become comfortable questioning AI.

Phase 3: AI Verification

Objective

Teach engineering verification.

Students should answer:

- Is this accurate?
- How do we know?
- What evidence supports this?
- What requires validation?

Verification should become habitual.

Phase 4: AI Governance

Objective

Teach authority boundaries.

Students should answer:

- What should AI do?
- What should AI not do?
- What requires human judgment?
- What decisions remain human owned?

Authority should be intentionally bounded.

Phase 5: AI Accountability

Objective

Teach engineering ownership.

Students should answer:

- What AI contributed
- What humans changed
- What humans verified
- What risks remain

Ownership should always remain visible.

Phase 6: AI Stewardship

Objective

Teach long-term responsibility.

Students should answer:

- How should AI be continuously governed?
- What operational risks exist?
- How will AI evolve?
- How will trust be maintained?

AI stewardship should become normal engineering behavior.

Normalize AI Disclosure

Students should routinely disclose AI usage.

Disclosure should become ordinary.

Students should answer:

- What AI was used?
- What was delegated?
- What was accepted?
- What was modified?
- What was verified?

Disclosure should become an engineering habit.

AI usage should never become invisible.

Facilitate AI Verification Behaviors

Students should continuously verify AI outputs.

Verification questions include:

- Is this accurate?
- Is this complete?
- Is this current?
- Is this operationally realistic?
- Is supporting evidence available?

Verification should occur before acceptance.

Facilitate AI Context Engineering

Students should understand that context is control.

Students should routinely ask:

- What information does AI need?
- What constraints exist?
- What assumptions should be avoided?
- What authority boundaries exist?

Context engineering should become a normal engineering skill.

Facilitate AI Risk Identification

Students should routinely identify AI risks.

Possible risks include:

- hallucinations
- missing context
- hidden assumptions
- outdated information
- overconfidence
- invisible dependencies

Risk identification should become habitual.

Facilitate AI Discussions

AI should become part of normal classroom discussions.

Students should routinely answer:

- Would AI help here?
- Should AI help here?
- What would you delegate?
- What should remain human controlled?
- What risks would AI introduce?

AI discussions should become ordinary engineering discussions.

Facilitate Human Judgment

Students should repeatedly exercise judgment.

Students should answer:

- Do we trust this?
- Why do we trust this?
- What evidence exists?
- What remains uncertain?

Judgment should become central.

Students should learn:

AI can accelerate decisions.

AI cannot replace judgment.

Facilitate AI Across The Semester

Early Course Emphasize:

- AI normalization
- AI awareness
- AI verification

Middle Course Emphasize:

- AI governance
- AI disclosure
- AI accountability

Late Course Emphasize:

- AI stewardship
- operational AI thinking
- long-term AI governance

Student ownership should continuously increase.

AI Facilitation Quality Checks

Before every AI-integrated activity ask:

Transparency Check Will AI usage be visible?

Verification Check Will outputs be challenged?

Accountability Check Will ownership remain human?

Risk Check Will students identify risks?

Stewardship Check Will students think long term?

If multiple answers are no, redesign the activity.

Common Anti-Patterns

Avoid:

AI Prohibition AI is completely banned.

AI Dependency AI is accepted without verification.

Invisible AI Usage Students hide AI involvement.

AI Exceptionalism AI is treated as a separate topic.

AI Worship Students assume AI is correct.

AI Fear Students avoid AI entirely.

AI Replacement Thinking Students assume AI replaces engineers.

Relationship To ETIS Educational Doctrine

AI facilitation operationalizes foundational ETIS principles.

- AI proposes; engineers verify.
- Governance is architecture.
- Context is control.
- Everything important leaves evidence.
- The model is not the system.
- A demo is not operational proof.

These principles should continuously appear throughout educational experiences.

Constitutional Educational Pillars

These principles should remain stable.

- AI is not a classroom tool. AI is an engineering participant.
- Do not teach students how to use AI. Teach students how to govern AI.
- The objective is not AI proficiency. The objective is AI stewardship.
- AI usage is not an academic violation. Undisclosed and unverified AI dependency is an engineering risk.
- Do not assess AI avoidance. Assess AI responsibility.
- Delegation is not ownership.
- Ownership never transfers to AI.

Relationship To The ETIS Transformation Model

AI should accelerate transformation, not replace it.

Student

↓

Responsible Engineer

↓

Reviewer

↓

Architect

↓

Release Defender

↓

Operational Thinker

↓

Future Trustworthy Engineer

Students should ultimately become trustworthy engineers capable of responsibly stewarding AI-enabled systems.

Long-Term Stewardship

Future educators should inherit AI governance systems rather than invent AI policies every semester.

The objective is not producing AI users.

The objective is producing trustworthy engineers capable of governing AI throughout their careers.

Review Board Facilitation Guide

Purpose

This document establishes how instructors should facilitate engineering review board experiences within ETIS classrooms.

Presentations communicate.

Review boards govern.

Review boards should simulate professional engineering accountability environments.

Students should not simply present work.

Students should defend engineering decisions.

Educational work should resemble professional engineering work.

Modern engineering increasingly requires engineers to explain, justify, defend, and steward their decisions.

Educational systems should intentionally teach those behaviors.

The objective is not presentation proficiency.

The objective is engineering accountability.

Core Question

This document answers:

> How should instructors facilitate engineering review board experiences within ETIS classroom experiences?

Educational Operations Philosophy

Engineering work is not complete until it can be defended.

Students should repeatedly experience environments where their engineering decisions are reviewed.

Review boards create those environments.

Review boards teach students how to:

- explain decisions
- defend evidence
- communicate risks
- disclose AI usage
- justify tradeoffs
- accept challenges
- operate uncertainty

Review boards should become expected engineering activities.

Foundational Principle

Engineering accountability should be experienced, not explained.

Students should repeatedly participate in accountability systems.

Accountability should become a normal engineering behavior rather than a special event.

Review Boards Are Governance Systems

Review boards are governance systems.

They are not presentations.

Review boards intentionally simulate professional engineering environments.

Review boards should evaluate:

- decisions
- evidence
- risks
- assumptions
- AI usage
- operational readiness

Students should become comfortable operating within those environments.

The Instructor's Role

The instructor is an educational operator.

The instructor should not become:

- the sole evaluator
- the sole question asker
- the sole authority figure

The instructor should facilitate governance.

The instructor should:

- create structure
- create accountability
- create transparency
- normalize challenge
- normalize uncertainty

The instructor should gradually transfer governance responsibilities to students.

Review Board Maturity Model

Review boards should mature throughout the semester.

Instructor Review
↓
Guided Review
↓
Collaborative Review
↓
Peer Review
↓
Governance Review

↓

Operational Review

↓

Professional Defense

Students should progressively assume greater ownership.

Core Components Of Every Review Board

Every review board should evaluate six dimensions.

Decision

↓

Evidence

↓

Risk

↓

AI Usage

↓

Operations

↓

Stewardship

Review boards should intentionally evaluate all six areas.

Decision Evaluation

Students should explain:

- What problem existed?
- What decision was made?
- Why was it chosen?
- What alternatives were considered?

Decision making should always be visible.

Evidence Evaluation

Students should explain:

- What evidence exists?
- Is the evidence sufficient?
- What evidence is missing?
- How trustworthy is the evidence?

Evidence should become central.

Conclusions should not be accepted without evidence.

Risk Evaluation

Students should explain:

- What risks exist?
- What risks remain?
- What assumptions exist?
- What uncertainties remain?

Risk communication should become routine.

Students should become comfortable discussing uncertainty.

AI Evaluation

Students should explain:

- What AI was used?
- What was delegated?
- What was verified?
- What human decisions remained?
- What AI risks remain?

AI disclosure should become expected.

Invisible AI usage should not exist.

Operational Evaluation

Students should explain:

- How will this operate?
- How will failures be detected?
- How will changes be managed?
- How will issues be resolved?

Operational thinking should become normal.

Stewardship Evaluation

Students should explain:

- How will this evolve?
- Who owns this?
- How will trust be maintained?
- What future work remains?

Stewardship should become visible.

Instructor Question Framework

Avoid presentation questions.

Avoid:

- Tell us what you built.
- Walk us through your slides.
- Explain your project.

Prefer governance questions.

Decision Questions

- Why was this decision made?
- What alternatives were rejected?

Evidence Questions

- What evidence supports this?
- What evidence is missing?

Risk Questions

- What risks remain?
- Which assumptions worry you?

AI Questions

- How was AI used?
- What required verification?

Operational Questions

- How will this operate?
- How will this evolve?

Stewardship Questions

- Who owns this long term?
- How will trust be maintained?

Normalize Uncertainty

Students should become comfortable saying:

- We are uncertain about this.
- Additional evidence is needed.
- This remains a risk.
- We would revisit this decision later.

Perfect answers should not be expected.

Responsible engineering should be expected.

Normalize Productive Challenge

Students should learn that being challenged is normal.

Challenges should target engineering work.

Challenges should never target individuals.

Students should become comfortable hearing:

- I have concerns about this assumption.
- I see additional risks.
- The evidence appears insufficient.

- I would evaluate another alternative.

Professional challenge should become routine.

Peer Review Boards

Students should progressively review each other.

Peer reviewers should evaluate:

- clarity
- evidence
- assumptions
- risks
- AI usage
- operational thinking

Students should learn how governance works from both sides.

Review Board Progression Throughout The Semester

Early Course Instructor emphasis:

- teach engineering defense
- teach evidence usage
- normalize questions

Middle Course Instructor emphasis:

- increase peer review
- increase accountability
- increase risk discussions

Late Course Instructor emphasis:

- facilitate governance
- facilitate operations
- facilitate stewardship

Student ownership should continuously increase.

Review Board Quality Checks

Before every review board ask:

Decision Check Will decisions be evaluated?

Evidence Check Will evidence be challenged?

Risk Check Will risks be discussed?

AI Check Will AI usage be visible?

Operational Check Will students think beyond implementation?

Stewardship Check Will long-term ownership be discussed?

If multiple answers are no, redesign the review board.

Common Anti-Patterns

Avoid:

Presentation Theater Students deliver slide decks without accountability.

Instructor Interrogation The instructor asks every question.

Evidence Blindness Conclusions are accepted without evidence.

Risk Avoidance Students avoid uncertainty.

Invisible AI Usage AI participation is hidden.

Operational Neglect Students stop at implementation.

Stewardship Blindness Long-term ownership is ignored.

Relationship To ETIS Educational Doctrine

Review boards operationalize foundational ETIS principles.

- AI proposes; engineers verify.
- Governance is architecture.
- Context is control.
- Everything important leaves evidence.
- The model is not the system.
- A demo is not operational proof.

These principles should continuously appear throughout review boards.

Constitutional Educational Pillars

These principles should remain stable.

- Presentations communicate. Review boards govern.
- Students should defend engineering decisions, not deliver presentations.
- Engineering accountability should be experienced, not explained.
- Engineering work is not complete until it can be defended.
- Evaluate the strength of the evidence before evaluating the strength of the conclusion.
- Responsible engineering includes communicating uncertainty.

Relationship To The ETIS Transformation Model

Review boards should accelerate professional formation.

Student
↓
Responsible Engineer

↓

Reviewer

↓

Architect

↓

Release Defender

↓

Operational Thinker

↓

Future Trustworthy Engineer

Review boards intentionally move students toward becoming release defenders and operational thinkers.

Long-Term Stewardship

Future educators should inherit engineering governance systems rather than invent presentation activities each semester.

The objective is not producing better presenters.

The objective is producing trustworthy engineers who can responsibly defend engineering decisions throughout their careers.

Part III

Classroom Stewardship

Classroom Energy Guide

Purpose

This document establishes how instructors should create and sustain engineering momentum throughout ETIS classroom experiences.

Energy is the sustained movement of engineering responsibility through the classroom.

The objective is not an energetic classroom.

The objective is a classroom with sustained engineering momentum.

Classroom energy is not entertainment.

Classroom energy is the continuous movement of students toward becoming trustworthy engineers.

Educational work should resemble professional engineering work.

Professional engineering is sustained through momentum, ownership, accountability, and purpose.

Educational systems should intentionally create those conditions.

Core Question

This document answers:

> How should instructors sustain engineering momentum throughout ETIS classroom experiences?

Educational Operations Philosophy

Energy should not come from instructor performance.

Energy should emerge from engineering ownership.

Students should understand:

- why activities exist
- how activities connect
- what they are building
- what evidence they are creating
- how they are maturing

Purpose creates energy.

Ownership sustains energy.

Foundational Principle

Students are energized when responsibility is meaningful.

Students lose energy when responsibility feels artificial.

Energy should come from authentic engineering work.

Avoid trying to create excitement.

Create engineering ownership instead.

The Instructor's Role

The instructor is an educational operator.

The instructor should not become:

- an entertainer
- a motivational speaker
- a content broadcaster

The instructor should create environments where engineering momentum naturally emerges.

The instructor should continuously reinforce:

- purpose
- ownership
- accountability
- progression
- transformation

Students should increasingly drive classroom energy themselves.

Engineering Momentum Model

Classroom energy should continuously move forward.

Purpose
↓
Ownership
↓
Artifacts
↓
Evidence
↓
Review
↓
Accountability
↓
Transformation

Momentum should never stall at any one stage.

Students should see continuous progress.

Sources Of ETIS Classroom Energy

Energy should come from multiple sources.

Purpose Energy Students understand why work matters.

Students should continuously answer:

- Why are we doing this?
- What engineering behavior are we strengthening?

Purpose should always be visible.

Ownership Energy Students should increasingly own engineering decisions.

Ownership questions include:

- What do we own?
- What decisions belong to us?
- What remains uncertain?

Ownership should continuously increase.

Artifact Energy Students should continuously create things.

Artifacts create visible progress.

Examples include:

- requirements
- architectures
- ADRs
- evidence packages
- AI disclosures
- risk inventories

Students should see engineering work accumulating over time.

Evidence Energy Students should see proof of progress.

Evidence answers:

- What have we demonstrated?
- What remains unsupported?
- What has matured?

Evidence makes growth visible.

Review Energy Students should routinely challenge engineering work.

Review creates movement.

Students should continuously ask:

- What can improve?
- What risks remain?
- What assumptions exist?

Review should become normal.

Accountability Energy Students should explain their decisions.

Students should answer:

- Why was this done?
- What evidence supports this?
- What alternatives exist?

Accountability creates professional ownership.

Energy Should Progress Throughout The Semester

Energy should evolve over time.

Early Semester Primary energy sources:

- curiosity
- exposure
- structure
- purpose

Instructor responsibility remains high.

Middle Semester Primary energy sources:

- ownership
- collaboration
- review
- evidence

Student responsibility increases.

Late Semester Primary energy sources:

- defense
- operations
- stewardship
- professional identity

Students should increasingly operate independently.

Energy Killers

Avoid these anti-patterns.

Lecture Saturation Students become passive consumers.

Artificial Activities Students cannot see relevance.

Invisible Progress Students cannot see growth.

Repetitive Work Activities feel disconnected.

Accountability Gaps Students are never asked to defend decisions.

Instructor Dependency Students wait for instructor direction.

AI Avoidance AI reality is ignored.

Keep Transformation Visible

Students should continuously see how they are changing.

Regularly reinforce the ETIS transformation model.

Student
↓
Responsible Engineer

↓

Reviewer

↓

Architect

↓

Release Defender

↓

Operational Thinker

↓

Future Trustworthy Engineer

Students should understand where they currently are.

Students should understand where they are going.

Transformation visibility sustains momentum.

Make Progress Visible

Students should regularly see accumulated work.

Possible visualizations include:

- artifact inventories
- evidence inventories
- milestone maps
- review histories
- engineering portfolios

Invisible progress reduces energy.

Visible progress increases energy.

Normalize Engineering Wins

Celebrate engineering behaviors rather than grades.

Recognize:

- excellent reviews
- strong evidence
- responsible AI usage
- thoughtful risk identification
- strong defenses
- operational thinking

Reward behaviors that build trustworthy engineers.

AI And Energy

AI should accelerate momentum.

AI should never replace ownership.

Students should routinely answer:

- What did AI accelerate?
- What required human judgment?
- What risks remain?

AI should increase engineering capacity, not decrease engineering accountability.

Classroom Energy Quality Checks

Before every session ask:

Purpose Check Can students explain why this matters?

Ownership Check Do students own something meaningful?

Artifact Check Will visible progress occur?

Evidence Check Will engineering accountability be demonstrated?

Transformation Check Will students move forward professionally?

If multiple answers are no, redesign the session.

Constitutional Educational Pillars

These principles should remain stable.

- Energy is the sustained movement of engineering responsibility through the classroom.
- The objective is not an energetic classroom. The objective is a classroom with sustained engineering momentum.
- Purpose creates energy.
- Ownership sustains energy.
- Educational work should resemble professional engineering work.
- Students should see transformation occurring throughout the semester.

Relationship To ETIS Educational Doctrine

This guide operationalizes foundational ETIS principles.

- Governance is architecture.
- Context is control.
- Everything important leaves evidence.
- AI proposes; engineers verify.
- The model is not the system.
- A demo is not operational proof.

These principles should continuously appear throughout classroom experiences.

Long-Term Stewardship

Future educators should inherit systems that sustain engineering momentum rather than invent engagement activities every semester.

The objective is not creating exciting classes.

The objective is creating classrooms that continuously produce trustworthy engineers.

Facilitation Scaling Guide

Purpose

This document establishes how ETIS classroom facilitation systems should scale across different educational environments.

Educational scale should increase engineering ownership, not administrative burden.

ETIS facilitation systems should remain stable regardless of institution, class size, course level, or delivery model.

Educational work should resemble professional engineering work.

Engineering accountability should remain constant.

Only complexity should scale.

Core Question

This document answers:

> How do ETIS classroom experiences scale without diluting engineering accountability?

Educational Operations Philosophy

Scaling should not create entirely new educational systems.

Scaling should adjust implementation while preserving doctrine.

The underlying philosophy should remain stable.

Students should always learn how to:

- define intent
- engineer context
- bound authority
- verify behavior
- operate reality
- explain decisions
- own outcomes

These expectations should not change.

Only the environments in which students practice them should change.

Foundational Principle

Scale autonomy, not instructor dependency.

As educational systems grow, students should assume more responsibility rather than instructors assuming more work.

Scaling should increase:

- ownership
- collaboration
- reviews
- governance

Scaling should not increase instructor centralization.

Stable Versus Scalable Components

Some components should never change.

Stable Components

These remain constant.

- ETIS doctrine
- engineering accountability
- engineering defense
- AI governance
- evidence expectations
- operational thinking
- transformation expectations

These are constitutional.

Scalable Components

These may vary.

- activity complexity
- project scope
- review depth
- governance frequency
- artifact sophistication
- team size

These are implementation choices.

Facilitation Scaling Model

ETIS should scale progressively.

Small Course

↓

Medium Course

↓

Large Course

↓

Multi-Section Course

↓

Program Level

↓

Institutional Level

The philosophy remains stable.

The operating mechanisms evolve.

Small Course Scaling

Typical Environment

10–25 students

Characteristics

High instructor interaction.

Frequent individual feedback.

Flexible discussions.

Recommended Emphasis

- guided discussions
- artifact reviews
- engineering defenses
- operational thinking

Instructor involvement remains relatively high.

Medium Course Scaling

Typical Environment

25–50 students

Characteristics

Balanced instructor and student ownership.

Increased team activities.

More structured reviews.

Recommended Emphasis

- peer reviews
- team facilitation
- engineering defenses
- AI governance

Students should increasingly govern themselves.

Large Course Scaling

Typical Environment

50–100 students

Characteristics

Instructor centralization becomes unsustainable.

Peer governance becomes necessary.

Recommended Emphasis

- review boards
- peer evaluations
- rotating facilitators
- engineering councils

Students should increasingly operate as engineering organizations.

Multi-Section Course Scaling

Typical Environment

Multiple instructors teaching the same course.

Challenges

Preventing instructional drift.

Standardize

- doctrine
- outcomes
- accountability expectations
- transformation expectations

Allow variation in:

- examples
- activities
- implementations

Doctrine should remain stable.

Program-Level Scaling

Typical Environment

Multiple ETIS-enabled courses.

Students should repeatedly encounter ETIS behaviors.

Examples include:

- engineering defenses
- AI disclosures
- evidence evaluations
- operational thinking

Students should experience continuity across courses.

ETIS should become part of institutional culture.

Institutional Scaling

Typical Environment

Entire departments or programs.

The goal becomes cultural transformation.

Students should repeatedly encounter:

- engineering accountability
- AI stewardship
- governance thinking
- operational thinking

ETIS should become an educational operating system.

Scale Student Ownership

Ownership should continuously increase.

Instructor Ownership
↓
Shared Ownership
↓
Team Ownership
↓
Peer Governance
↓
Engineering Organizations
↓
Professional Ownership

Scaling should move upward through this progression.

Scale Reviews

As classrooms grow, reviews become essential.

Review ownership should evolve.

Small Courses Instructor reviews dominate.

Medium Courses Peer reviews increase.

Large Courses Peer governance dominates.

Institutional Scale Distributed review systems emerge.

Review becomes part of educational infrastructure.

Scale Engineering Defenses

Defenses should evolve.

Small Courses Informal defenses.

Medium Courses Structured defenses.

Large Courses Review boards.

Institutional Scale Governance simulations.

Defense expectations should always remain visible.

Scale AI Facilitation

AI should remain integrated at every level.

Do not isolate AI into separate modules.

Students should continuously answer:

- What AI was used?
- What was delegated?
- What was verified?
- What risks remain?

These questions should never disappear.

Scale Artifact Systems

Artifacts become increasingly important at larger scales.

Possible artifacts include:

- requirements
- architectures
- ADRs
- evidence inventories
- AI disclosures
- review findings

Artifacts create continuity.

Artifacts reduce instructor dependency.

Artifacts preserve institutional memory.

Scale Through Roles

As systems grow, students should assume additional responsibilities.

Possible roles include:

- engineering lead
- architecture lead
- review lead
- evidence lead
- operations lead
- AI governance lead

Roles create ownership.

Ownership creates sustainability.

Scaling By Educational Environment

Environment	Recommended Facilitation Emphasis
Sophomore Course	Structure, ownership, foundational engineering behaviors
Junior Course	Collaboration, reviews, AI responsibility
Senior Course	Governance, defense, operations
Graduate Course	Stewardship, organizational thinking
Bootcamp	Rapid ownership, evidence, accountability
Corporate Training	Governance, AI stewardship, operational thinking

The environment changes.

The doctrine remains stable.

Facilitation Quality Checks

Before scaling ask:

Accountability Check Will engineering accountability remain visible?

Ownership Check Will student ownership increase?

Review Check Will reviews remain routine?

AI Check Will AI governance remain visible?

Operational Check Will students think beyond implementation?

If multiple answers are no, redesign the scaling approach.

Common Anti-Patterns

Avoid:

Administrative Scaling Increasing instructor workload instead of student ownership.

Accountability Reduction Lowering expectations for larger classes.

AI Isolation Treating AI separately from engineering work.

Review Elimination Reducing reviews because of scale.

Instructor Centralization Making instructors the bottleneck.

Institutional Drift Allowing doctrine to vary between implementations.

Constitutional Educational Pillars

These principles should remain stable.

- Scale complexity, not accountability.
- Scale autonomy, not instructor dependency.
- Educational scale should increase engineering ownership, not administrative burden.
- Educational work should resemble professional engineering work.
- Engineering accountability is the educational outcome, not the side effect.
- Engineering work is not complete until it can be defended.

Relationship To The ETIS Transformation Model

Scaling should never alter transformation expectations.

Student

↓

Responsible Engineer

↓

Reviewer

↓

Architect

↓

Release Defender

↓

Operational Thinker

↓

Future Trustworthy Engineer

The pathway remains constant.

Only implementation mechanisms change.

Long-Term Stewardship

Future educators should inherit scalable facilitation systems rather than redesign classroom operations for every new environment.

The objective is not scaling courses.

The objective is scaling trustworthy engineer formation.

COMP330 Facilitation Reference

Purpose

This document provides the flagship implementation reference for ETIS classroom facilitation using Loyola University Chicago COMP330.

The flagship implementation proves the doctrine.

It does not become the doctrine.

This document demonstrates how ETIS facilitation systems can be operationalized within a real software engineering course.

The examples contained here are implementation references rather than mandatory prescriptions.

Future educators should adapt the implementation while preserving ETIS doctrine.

Educational work should resemble professional engineering work.

COMP330 operationalizes that philosophy.

Core Question

This document answers:

> What does ETIS classroom facilitation look like in a real educational environment?

Course Context

Course:

COMP330 - Software Engineering

Institution:

Loyola University Chicago

Educational Model:

Flagship ETIS Implementation

Primary objective:

Progressively transform students into trustworthy engineers.

Students should repeatedly practice engineering accountability rather than simply learn software engineering concepts.

COMP330 Facilitation Philosophy

COMP330 is not operated as a traditional lecture course.

COMP330 is operated as an engineering environment.

Students are expected to:

- make decisions
- create artifacts
- review peers
- defend decisions
- disclose AI usage
- communicate risks

- think operationally

The classroom progressively becomes less instructor centered and more engineering centered.

Instructor Role

The instructor functions as an educational operator.

The instructor does not primarily serve as:

- lecturer
- project manager
- evaluator

The instructor primarily serves as:

- facilitator
- reviewer
- architect
- governance operator
- transformation guide

Instructor centralization should continuously decrease throughout the semester.

Semester Facilitation Progression

COMP330 gradually shifts ownership.

```
Weeks 1-4
Instructor Led
    ↓
Weeks 5-8
Instructor Guided
    ↓
Weeks 9-12
Collaborative Engineering
    ↓
Weeks 13-16
Review Driven Engineering
    ↓
End Of Semester
Professional Engineering Simulation
```

Students should visibly experience this transition.

Typical COMP330 Session Structure

Most sessions follow a repeatable pattern.

```
Context
```

↓

Discussion

↓

Engineering Work

↓

Review

↓

Reflection

Sessions intentionally resemble engineering meetings rather than lectures.

Typical Session Flow

Context Briefly establish why the topic matters.

Questions may include:

- Why does this exist?
- Why should engineers care?
- Where does this fail?

Context is intentionally brief.

Discussion Students participate in engineering conversations.

Topics may include:

- assumptions
- risks
- tradeoffs
- AI usage
- operational impacts

Discussion focuses on engineering reasoning.

Engineering Work Students actively create engineering artifacts.

Examples include:

- requirements
- architectures
- WBS structures
- RACI assignments
- AI disclosures
- evidence packages

Artifact production dominates classroom time.

Review Students review engineering work.

Students challenge:

- assumptions
- evidence

- AI usage
- risks

Review becomes routine.

Reflection Students answer:

- What changed?
- What surprised you?
- What remains uncertain?
- What would you improve?

Reflection consolidates learning.

Team Facilitation Within COMP330

Teams operate as engineering organizations.

Students progressively learn how to:

- coordinate
- review
- negotiate
- escalate
- defend decisions

Students are discouraged from simply dividing work.

Team engineering is emphasized over group project thinking.

AI Facilitation Within COMP330

AI is integrated throughout the semester.

AI is never isolated into a single module.

Students routinely answer:

- What AI was used?
- What was delegated?
- What was verified?
- What risks remain?

Responsible AI usage becomes habitual engineering behavior.

Review Board Facilitation Within COMP330

Engineering defenses occur repeatedly.

Students defend:

- decisions
- evidence
- assumptions
- risks
- AI usage

Students become increasingly comfortable communicating uncertainty.

The goal is not perfect answers.

The goal is responsible engineering accountability.

Engineering Behaviors Reinforced Throughout The Semester

Students repeatedly practice:

Defining Intent Understanding why engineering work exists.

Engineering Context Providing sufficient information for decisions.

Bounding Authority Determining what should remain human controlled.

Verifying Behavior Challenging assumptions and validating outputs.

Operating Reality Thinking beyond implementation.

Explaining Decisions Communicating reasoning.

Owning Outcomes Accepting responsibility.

These behaviors appear continuously.

Common Instructor Phrases

Certain phrases intentionally reinforce ETIS doctrine.

Examples include:

Engineering Accountability

Engineering work is not complete until it can be defended.

AI Responsibility

AI proposes; engineers verify.

Evidence Thinking

Evaluate the strength of the evidence before evaluating the strength of the conclusion.

Engineering Ownership

The objective is not completing assignments. The objective is becoming engineers.

Operational Thinking

Building something is only the beginning. Operating it is the real challenge.

These messages should continuously reappear.

Student Experience Evolution

Students should experience a progression.

Early Semester Students ask:

What am I supposed to do?

Middle Semester Students ask:

What evidence supports this?

Late Semester Students ask:

What risks remain?

End Of Semester Students ask:

How would engineers operate this over time?

This progression is intentional.

Evidence Of Transformation

By the end of COMP330, students should increasingly demonstrate:

- evidence-based thinking
- responsible AI usage
- engineering accountability
- peer review behaviors
- operational thinking
- governance thinking

These outcomes matter more than content memorization.

Relationship To The ETIS Transformation Model

COMP330 intentionally operationalizes this pathway.

Student

↓

Responsible Engineer

↓

Reviewer

↓

Architect

↓

Release Defender

↓

Operational Thinker

↓

Future Trustworthy Engineer

The course continuously reinforces this progression.

Adoption Guidance For Other Institutions

Do not copy COMP330.

Adapt COMP330.

Preserve:

- ETIS doctrine
- engineering accountability
- AI stewardship
- evidence expectations
- operational thinking

Adapt:

- examples
- projects
- schedules
- technologies
- institutional constraints

The doctrine should remain stable.

The implementation should remain flexible.

Constitutional Educational Pillars

These principles should remain visible.

- Educational work should resemble professional engineering work.
- Engineering accountability is the educational outcome, not the side effect.
- Engineering work is not complete until it can be defended.
- AI usage is not an academic violation. Undisclosed and unverified AI dependency is an engineering risk.
- The flagship implementation proves the doctrine. It does not become the doctrine.
- The objective is not successful projects. The objective is trustworthy engineers.

Long-Term Stewardship

COMP330 should continue serving as a living implementation reference for ETIS.

It should evolve.

It should improve.

It should contribute assets back into ETIS.

However, COMP330 should never replace ETIS doctrine.

The objective is not preserving a course.

The objective is preserving a reusable educational ecosystem that continuously produces trustworthy engineers.