

Future-Oriented Intervention Blueprint

30-Minute Advisor–Advisee Structured Advising Conversation

Intervention Title

“Belonging, Pathways, and Professional Identity in Mechanical Engineering”

Target Student Population

- Primary audience: Undergraduate women majoring in Mechanical Engineering
 - Institutional context: Midwestern polytechnic university
 - Demographic reality: Women represent approximately 10% of the ME student population, increasing risks of social isolation, stereotype threat, and attrition
 - Advising context: One-to-one academic advising meeting between a faculty or professional advisor and a female ME student
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Risk Indicators Addressed

This intervention is designed for students who may show one or more of the following early risk indicators:

1. Lack of belonging
 - Reports feeling “out of place” in classes or labs
 - Limited peer connections within the major
 - Perception of being the “only one” or hyper-visible in group work
 2. Weak professional identity formation
 - Difficulty seeing oneself as a “mechanical engineer”
 - Uncertainty about fit with engineering culture or careers
 3. Reduced help-seeking behavior
 - Hesitation to attend office hours, tutoring, or student orgs
 - Fear of confirming stereotypes or appearing less competent
 4. Disengagement signals
 - Considering switching majors despite adequate academic performance
 - Expressing loneliness, low motivation, or diminished confidence
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Theoretical Basis (Aligned With Common STEM Retention References)

1. Sense of Belonging Theory (Strayhorn)

- Belonging is a basic human need and a critical predictor of persistence for marginalized students in STEM.
- The intervention explicitly names belonging as legitimate and important, rather than incidental.

Application: Advisor normalizes belonging concerns and helps the student identify or build affirming academic and social spaces.

2. Tinto's Model of Student Persistence

- Persistence depends on academic and social integration.
- For underrepresented students, social integration within the discipline (not just the institution) is especially important.

Application: Advisor links coursework, peer interaction, and co-curricular engagement directly to persistence in mechanical engineering.

3. Social Identity Theory

- Students assess whether “people like me” belong and succeed in a field.
- Underrepresentation increases identity threat and self-doubt.

Application: Advisor highlights visible pathways, role models, and peer micro-communities that counter isolation.

4. Communities of Practice

- Engineering identity develops through legitimate participation in disciplinary communities.
- Peripheral participation (e.g., study groups, project teams, student orgs) matters.

Application: Advisor frames involvement not as “extra” but as part of becoming an engineer.

5. Self-Determination Theory

- Persistence is supported by autonomy, competence, and relatedness.

Application: Student co-constructs goals (autonomy), reflects on strengths (competence), and identifies connection points (relatedness).

30-Minute Structured Intervention Agenda

0–5 Minutes | Welcome & Psychological Safety

Advisor Goals

- Establish trust and normalize the conversation
- Signal that belonging and identity are valid advising topics

Advisor Prompts

- “I like to use part of our advising time to talk about how students are experiencing the *culture* of mechanical engineering, not just courses.”
- “Many women in ME tell me that finding a sense of belonging can take extra work—so I want to check in about that.”

Intentional Move

- Advisor names gendered underrepresentation explicitly to reduce self-blame.
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5–10 Minutes | Experience Mapping

Advisor Goals

- Identify belonging gaps and strengths
- Surface risk indicators early

Guided Questions

- “Where do you feel most comfortable in the ME program right now? Least comfortable?”
- “Are there spaces—classes, labs, groups—where you feel you can be fully yourself?”
- “When challenges come up, who do you tend to turn to?”

Advisor Listening Focus

- Language of isolation, invisibility, or over-scrutiny
- Evidence of informal communities or missed connection opportunities

10–18 Minutes | Reframing & Validation (Theory-Informed)

Advisor Goals

- Normalize struggles using theory
- Reframe belonging as developmental, not personal failure

Advisor Talking Points

- “Feeling unsure about fit is very common when you’re one of the few. Research shows it’s often about the environment—not ability.”
- “Engineering identity develops through participation. It’s okay if it doesn’t feel automatic yet.”

Micro-Intervention

- Advisor explicitly connects the student’s experiences to belonging theory and identity development, reducing stereotype threat.
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18–25 Minutes | Forward-Looking Pathway Building

Advisor Goals

- Translate theory into concrete next steps
- Strengthen autonomy and agency

Co-Constructed Actions (Choose 1–2)

- Identify one small, low-risk community entry point (e.g., women-in-engineering group, project team, peer mentor).
- Map a near-term professional identity moment (e.g., undergraduate research, industry talk, design competition).
- Strategize how to navigate group work or labs where the student feels marginalized.

Advisor Framing

- “These aren’t add-ons; they’re part of how engineers become engineers.”
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25–30 Minutes | Reflection, Commitment, and Follow-Up

Advisor Goals

- Reinforce competence and belonging

- Create continuity beyond the meeting

Closing Prompts

- “What’s one thing from today that felt most affirming or useful?”
- “What’s one step you’re willing to try before we meet again?”

Advisor Action

- Document the plan in advising notes
 - Schedule a belonging-focused check-in, not just course registration
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Outcomes This Intervention Targets

- Increased sense of belonging within mechanical engineering
- Stronger engineering identity
- Earlier connection to disciplinary communities
- Reduced risk of attrition among women in ME

Advisor Script

30-Minute Advising Conversation: Women in Mechanical Engineering

Purpose:

Support sense of belonging, engineering identity, and persistence for women in mechanical engineering at a midwestern polytechnic university where women comprise ~10% of the major.

0–5 Minutes | Set the Frame & Normalize Belonging

Advisor Opening (use or adapt):

“In addition to courses and degree progress, I like to spend time talking about how students experience the *culture* of mechanical engineering. For women especially, feeling a sense of belonging can take extra effort, so I want to check in on that today.”

Key Advisor Moves

- Explicitly name underrepresentation to reduce self-blame
 - Signal that belonging is a *legitimate* advising topic
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5–10 Minutes | Explore the Student’s Experience

Ask (choose 2–3):

- “Where do you feel most comfortable in the ME program right now? Where do you feel least comfortable?”
- “Are there classes, labs, or group settings where you feel like you really belong?”
- “When things get challenging academically or personally, who do you usually turn to?”
- “Have you ever had moments where you wondered whether ME was the right fit for you?”

Listen For

- Isolation, invisibility, or hyper-visibility
 - Lack of peer or faculty connection
 - Hesitation to seek help or engage
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10–18 Minutes | Validate & Reframe (Theory-Informed)

Advisor Validation Statements

Key Reframes

- Belonging is *developmental*, not personal failure
 - Feeling uncertain does not indicate lack of competence
 - Participation builds identity (not the other way around)
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18–25 Minutes | Build a Forward-Looking Pathway

Advisor Prompt:

“Let’s think about one or two concrete steps that could help you feel more connected *as a mechanical engineer* over the next few weeks.”

Co-Create 1–2 Actions

- Join or re-engage with a women-in-engineering or ME-related student group
 - Identify a peer or mentor in the major (classmate, TA, faculty)
 - Participate in a disciplinary activity (project team, research, design competition, industry talk)
 - Plan a strategy for group work or lab environments that feel challenging
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25–30 Minutes | Reflect, Commit, and Follow Up

Reflection Question

- “What part of today’s conversation felt most helpful or affirming?”

Commitment Question

- “What’s one step you feel ready to try before we meet again?”

Advisor Close

- Affirm strengths and persistence
 - Schedule a follow-up that revisits belonging and identity, not just registration
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Advisor Notes (Post-Meeting)

- Document risk indicators (if present)
 - Record agreed-upon actions
 - Flag student for proactive check-in if isolation or disengagement is high
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Intended Outcomes

- Increased sense of belonging in mechanical engineering
- Stronger professional identity
- Earlier connection to disciplinary communities
- Reduced risk of attrition

Faculty Advisor Training Handout

Supporting Women in Mechanical Engineering Experiencing Early Disengagement

Purpose of This Intervention

This advising intervention is designed to support persistence, belonging, and professional identity formation for undergraduate women in Mechanical Engineering who show early signs of disengagement. Research-aligned advising that explicitly addresses belonging and identity can reduce attrition for students who are underrepresented in the discipline.

Who Should Receive This Intervention?

Use this approach when a student shows one or more early disengagement indicators, including:

- Missed Week One Orientation
- Missed 3+ classes in the first two weeks
- No involvement by week 5
- First-generation status
- Expressing uncertainty about fit or belonging in ME

Important: These indicators signal *risk*, not lack of ability.

Advisor Role: What This Is (and Is Not)

This is:

- A 30-minute structured conversation
- Proactive, not remedial
- Focused on belonging, identity, and connection

This is not:

- Academic probation advising
- Therapy or crisis intervention
- A one-size-fits-all checklist

30-Minute Advising Structure (Quick Reference)

0–5 Minutes | Set the Frame

Advisor Goals

- Establish psychological safety
- Normalize belonging as a legitimate concern

Suggested Opening

“In addition to courses and degree progress, I like to talk about how students experience the *culture* of mechanical engineering. For women especially, belonging can take extra effort.”

Key Move

- Explicitly name underrepresentation to reduce self-blame
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5–10 Minutes | Explore the Student’s Experience

Ask 2–3 Questions

- “Where do you feel most comfortable in ME right now? Least comfortable?”
- “Are there classes or labs where you feel like you really belong?”
- “When challenges come up, who do you usually turn to?”

Listen For

- Isolation or invisibility
 - Lack of peer or faculty connection
 - Hesitation to seek help
-

10–18 Minutes | Validate & Reframe

Advisor Goals

- Normalize struggle
- Reframe belonging as *developmental*, not personal failure

Key Reframes

- Feeling uncertain ≠ lack of competence
- Engineering identity develops through participation

- Environment matters, not just individual effort
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18–25 Minutes | Build a Forward-Looking Pathway

Co-Create 1–2 Actions Choose low-risk, high-impact steps such as:

- Re-engaging with a women-in-engineering or ME-related group
- Identifying a peer, TA, or faculty mentor
- Attending one disciplinary event (talk, research meeting, project team)
- Planning a strategy for group work or labs that feel challenging

Advisor Framing

“These aren’t extras—they’re part of becoming an engineer.”

25–30 Minutes | Reflect & Commit

Reflection Question

- “What part of today felt most helpful or affirming?”

Commitment Question

- “What’s one step you feel ready to try before we meet again?”

Advisor Action

- Document risk indicators and agreed-upon actions
 - Schedule a belonging-focused follow-up, not just registration
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After the Meeting: Advisor Checklist

- ☐ Record disengagement indicators
 - ☐ Document action steps
 - ☐ Flag for proactive follow-up if isolation is high
 - ☐ Revisit belonging and identity at next check-in
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Intended Outcomes

- Increased sense of belonging in Mechanical Engineering
- Stronger professional identity as an engineer
- Earlier and sustained engagement in disciplinary communities

- Reduced risk of attrition among women in ME
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Key Reminder for Advisors

Belonging and identity are core academic issues for underrepresented students in engineering—not “soft” concerns. Addressing them early is an evidence-informed retention strategy.

Assessment Plan for Evaluating Intervention Success

Purpose of Assessment

The purpose of this assessment plan is to evaluate whether the structured, early intervention for female Mechanical Engineering students successfully mitigates the disengagement indicators achieves the short-, intermediate-, and long-term outcomes.

Assessment focuses on change over time for students flagged by early disengagement indicators, rather than comparison to the general student population.

Alignment Framework: Indicators → Outcomes → Measures

The assessment plan is aligned to:

- Early disengagement indicators
 - Program outputs and outcomes
 - Multiple levels of evidence (behavioral, perceptual, and institutional)
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1. Process & Output Measures (Implementation Fidelity)

Purpose: Determine whether the intervention is being delivered as designed.

Program Element	Measure	Data Source	Success Criterion
Students flagged by indicators	Number and type of indicators per student	Early alert / advising records	100% of flagged students documented
Structured advising conversation	Completion of standardized advising session	Advising notes	≥90% completion rate
Action planning	Number of co-constructed engagement actions	Advising documentation	≥1 action per student
Follow-up check-in	Completion of follow-up within 6–8 weeks	Advising logs	≥75% follow-up completion

These outputs directly correspond to the Inputs, Activities, and Outputs sections of the Intervention Plan.

2. Short-Term Outcome Measures (0–8 Weeks)

Purpose: Assess whether the intervention reduces the impact of early disengagement indicators.

Key Indicators Addressed

- No involvement by week 5
- Missed orientation
- Missed classes early in term
- First-generation status as a compounding risk factor

Measures

Outcome	Indicator-Aligned Measure	Data Source	Evidence of Success
Increased sense of belonging	Belonging self-report (pre/post)	Short survey or reflection	Positive change from baseline
Reduced disengagement behaviors	Attendance at ≥ 1 ME-related activity	Involvement center records	Increase from zero to one or more
Increased help-seeking	Contact with advisor, TA, tutor, or peer mentor	Advising notes / self-report	Documented engagement
Reduced early risk signals	No new missed-class alerts	Early alert system	Fewer or stabilized alerts

These measures map directly to the Short-Term Outcomes listed in the Intervention Plan.

3. Intermediate Outcome Measures (1–2 Semesters)

Purpose: Determine whether early behavioral and perceptual changes persist.

Outcome	Measure	Data Source	Success Indicator
Sustained involvement	Continued participation in ME-related activities	Involvement records	Participation in ≥ 1 semester
Stronger professional identity	Identity affirmation reflection or survey	End-of-semester reflection	Qualitative evidence of identification with ME
Academic and social integration	Enrollment in subsequent ME courses	Registration data	On-track enrollment
Continued help-seeking	Ongoing advisor or faculty contact	Advising logs	≥ 1 contact per term

These align with the Intermediate Outcomes articulated in the Intervention Plan.

4. Long-Term Outcome Measures (Retention & Persistence)

Purpose: Evaluate whether the intervention contributes to improved equity-focused retention outcomes.

Primary Measures

Outcome	Measure	Data Source
Retention in ME	Year-to-year persistence in major	Institutional retention data
Reduced attrition among flagged students	Comparison of flagged vs. historical flagged cohorts	Program-level analysis
Equity improvement	Retention of women flagged by indicators	Disaggregated retention data

Retention is explicitly identified as a key concern, including historical retention rates for Mechanical Engineering cohorts.

5. Assessment Design Considerations

- Baseline comparison: Each student serves as their own baseline (pre/post intervention).
- Equity lens: Outcomes are interpreted relative to students flagged by disengagement indicators, not the general population.
- Mixed-methods approach: Quantitative indicators are triangulated with advising notes and student reflections.

These design choices align with the assumptions and external factors identified in the Intervention Plan.

Summary of Success Criteria

The intervention will be considered successful if:

1. The structured intervention is implemented with high fidelity.
2. Students demonstrate measurable reductions in disengagement behaviors linked to Assignment 1 indicators.
3. Short-term gains in belonging and engagement persist into subsequent semesters.
4. Retention outcomes for flagged female ME students improve relative to historical patterns.

Guiding Principle for Communicating Results

Assessment results should be communicated in ways that are:

- Purpose-aligned (improvement, accountability, equity)
- Audience-specific (detail and framing vary by role)
- Ethically responsible (no deficit framing of students)
- Actionable (clearly tied to decisions or improvements)

This aligns with the intervention's emphasis on *belonging, equity, and early support rather than remediation or punishment* as articulated in the Intervention Plan.

1. Primary Audiences and Communication Strategies

A. Department Leadership (Chair, Program Director, Retention Committees)

Purpose

- Program evaluation
- Resource allocation
- Strategic decision-making

What to Communicate

- Aggregate results only (no individual student data)
- Trends in:
 - Reduction of disengagement indicators
 - Short- and intermediate-outcome attainment
 - Retention of flagged students over time

Format

- Annual or end-of-cycle summary report
- Tables or dashboards showing:
 - Number of students served
 - Indicator change (pre/post)
 - Retention comparisons to historical cohorts

Framing

- Emphasize system responsiveness, not student deficits
- Frame outcomes as evidence of *whether early, structured intervention works for this population*

Rationale Retention and disengagement indicators are explicitly identified as concerns, making leadership a primary audience for results.

B. Advisors and Faculty Implementing the Intervention

Purpose

- Continuous improvement
- Fidelity of implementation
- Professional learning

What to Communicate

- Process and short-term outcome data:
 - Which components were completed
 - Which actions students most often chose
 - Patterns in engagement response (what seems to help)

Format

- End-of-term internal briefing
- Facilitated discussion or written memo
- De-identified case patterns or exemplars

Framing

- Reflective and formative
- Focus on:
 - “What worked for students like ours?”
 - “Where did students disengage despite intervention?”

Rationale The intervention relies on structured advising conversations and follow-up; therefore, implementers need feedback to refine practice, even though this use is not explicitly spelled out in the documents (recommended practice).

C. Institutional Stakeholders (Assessment, Student Success, Equity Offices)

Purpose

- Accountability
- Equity monitoring
- Alignment with institutional priorities

What to Communicate

- Disaggregated results for:
 - Gender
 - First-generation status (where appropriate)
- Evidence that the intervention addresses populations “disproportionately affected.”

Format

- Standard assessment report
- Contribution to institutional retention or equity reporting cycles

Framing

- Equity-focused and evidence-based
 - Emphasize closing opportunity gaps rather than raising expectations of students alone
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D. Students (Indirect, Ethical Communication)

Purpose

- Transparency
- Trust-building
- Program legitimacy

What to Communicate

- High-level findings only:
 - “Students who participated were more likely to engage early”
 - “The department is investing in belonging-focused support”

Format

- Brief summary shared through:
 - Department newsletters
 - Orientation or advising materials

What *Not* to Communicate

- Individual results
- Comparisons that label students as “at risk” or “deficient”

Rationale While students are not assessors, ethical practice supports communicating *why* interventions exist and *what they are designed to improve*, consistent with the intervention’s assumptions about belonging and identity.

2. Timing of Communication

Stage	Audience	Focus
End of intervention cycle	Advisors / faculty	Implementation & short-term outcomes
End of semester	Department leadership	Intermediate outcomes
Annual review	Institutional stakeholders	Retention & equity trends

(This timing structure is recommended practice; the documents themselves define outcomes by time horizon but do not prescribe reporting schedules.)

3. Data Ethics and Framing Standards

All communications should adhere to the following:

- Use aggregate data whenever possible
 - Avoid language that equates disengagement with lack of ability
 - Explicitly acknowledge external factors noted in the Intervention Plan (e.g., climate, time constraints) when interpreting results
 - Present findings as *evidence for program learning*, not proof of individual success or failure
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Summary

Assessment results should be communicated:

- **Upward** to leadership for decision-making
- **Laterally** to advisors and faculty for improvement
- **Outward** to institutional stakeholders for accountability
- **Carefully** to students for transparency and trust

When framed correctly, assessment communication becomes an extension of the intervention itself—reinforcing a culture of belonging, reflection, and shared responsibility for student persistence.