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# Curriculum Evaluation for the Improvement of STEM Programs of Study

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The logo features a stylized green 'S' shape that curves from the bottom left towards the top right, passing behind the text. The text 'pathways' is in a large, white, lowercase sans-serif font, and 'resource center' is in a smaller, white, lowercase sans-serif font below it.

pathways  
resource center

The **mission** of the PRC is to provide resources and supports to secondary and postsecondary institutions, employers, communities, and other partners as they engage in successful and sustainable pathways for students from secondary, to postsecondary, to careers.

An Affiliate of the Office of Community College Research and Leadership  
University of Illinois at Urbana-Champaign

# Background

- Recently, we have finalized and printed a new module for educators.
  - It is complemented by **Pathways to Results (PTR)** and is meant to guide educators and their partners through a **series of steps** as they evaluate and improve their STEM curricula.
  - It also includes several templates, included in as appendices and available as individual files on our website.



# Background – Author/Speaker



- Curriculum Specialist and Coach at Pathways Resource Center
- Formerly School Psychologist, Coordinator of Research and Assessment, Director of World Languages, and Director of Personnel Services
- Evaluative Methods Specialization

*Author Quote:* “Evaluation—especially of curriculum—is awesome!”

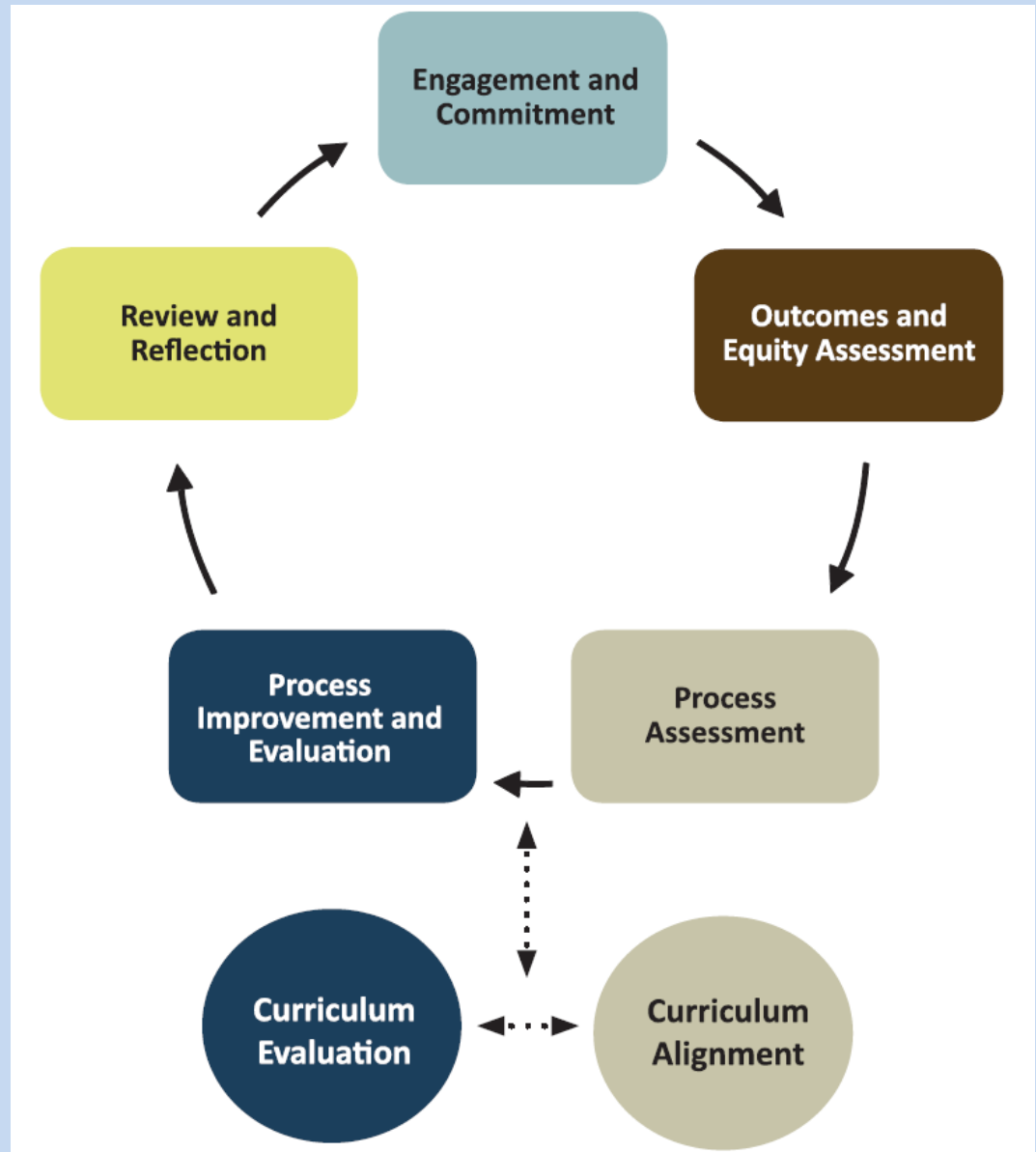


# Accessing the Module

- ***Electronically:*** Go to [www.pathways.illinois.edu](http://www.pathways.illinois.edu) (currently found midway on the page)
- ***In print:*** Please feel free to contact us to make a request (my email: [jrmalin2@illinois.edu](mailto:jrmalin2@illinois.edu))
  - We have also mailed 4 copies to our primary contacts at each of the *Race to the Top* school districts we support.

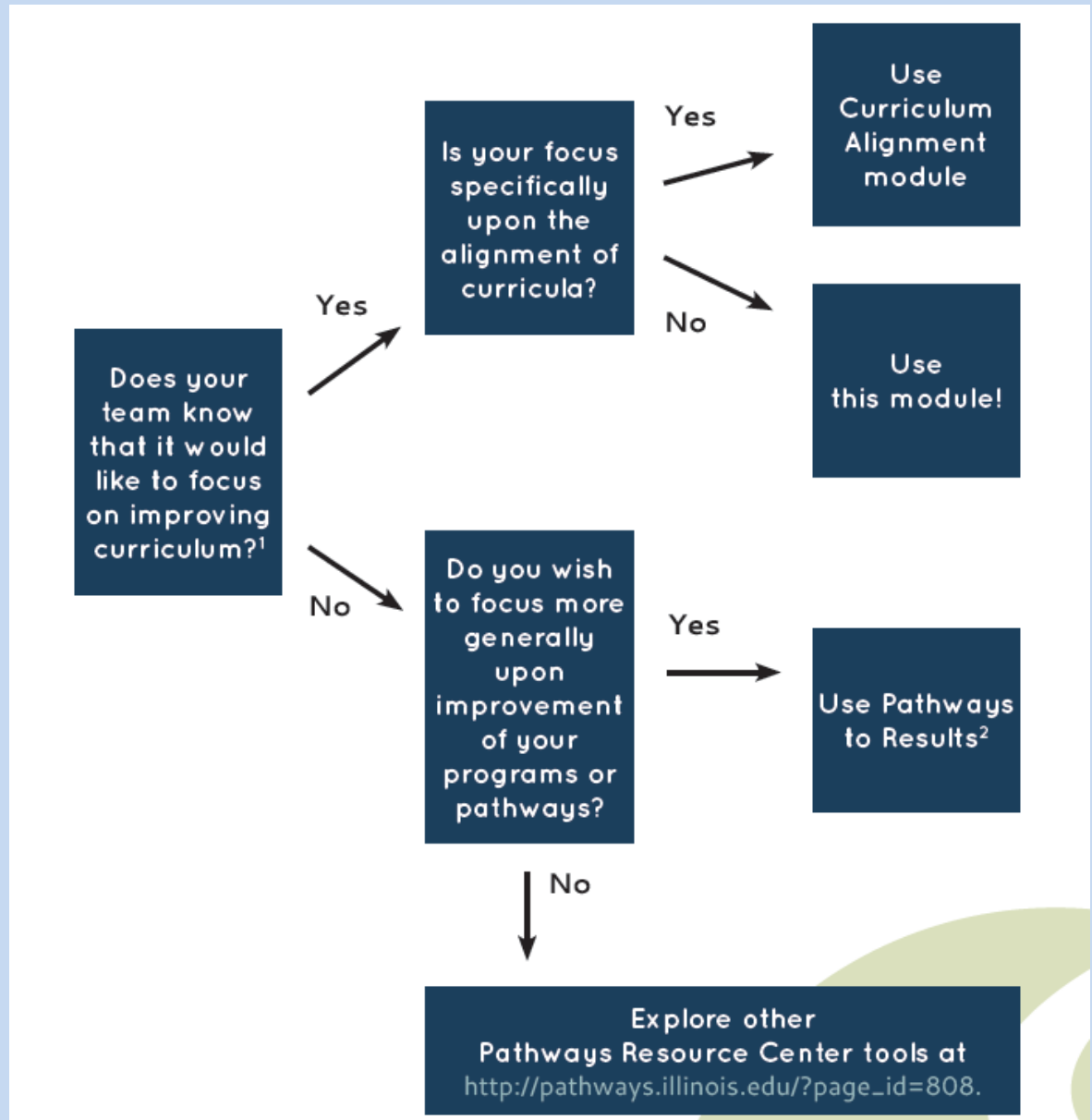


**Pathways to Results (PTR)** is an outcomes-focused, equity-guided process to improve pathways and programs that support student transition to and through postsecondary education and employment. PTR focuses on addressing equity gaps between diverse learner groups and continuously improving processes critical to student success, including retention, completion of postsecondary credentials, and transition to employment.



# Decision Chart:

Identifying the best resource given your current needs.



# Importance

- Matters of curriculum are at the **heart** of education
  - What do we want students to learn?
  - What progression is optimal?
  - How will we present a concept to make it memorable, relevant and interesting?

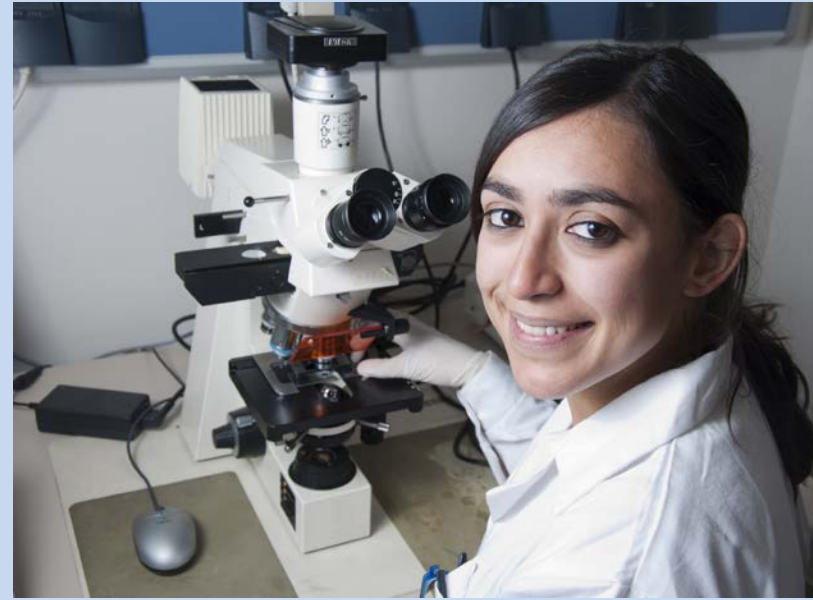


Through systematic evaluation of curricula, we are most likely to make wise decisions, thereby improving students' learning experiences



# Importance

- When concerning STEM programs and pathways, the importance of curriculum evaluation may be elevated still more:
  - Centrality of STEM programming for individuals and society
  - Rapidly changing technologies and necessary skill sets, and need to maintain currency/relevance



## Why evaluate curriculum?

Curriculum assessment can serve several purposes, including:

- Identify aspects of a curriculum that are working and those that are not
- Assess the effectiveness of changes that have been made
- Demonstrate the effectiveness of a curriculum, component, or program
- Comply with regular program or curriculum review requirements
- Satisfy professional accreditations

Adapted from Wolf, P., Hill, A., & Evers, F. (2006). *Handbook for curriculum assessment: Winter 2006*. Guelph, Ontario: University of Guelph.



# Curriculum (defined)

- Curriculum has been defined in a multitude of ways; this module employs a broad definition: “The curriculum consists of the ongoing experiences of children under the guidance of the school” (Ragan & Shepherd, 1971, pp. 3-4).



## Is This Curriculum?

Which of the following is part of this module's working definition of curriculum?

- A. A syllabus for a course
- B. A Career and Technical Student Organization
- C. A school-sponsored internship program
- D. All of the Above





## What is STEM Education?

“...an interdisciplinary approach to learning where rigorous academic concepts are coupled with real-world lessons as students apply science, technology, engineering, and mathematics in contexts that make connections between school, community, work, and the global enterprise enabling the development of STEM literacy and with the ability to compete in the new economy” (Tsupros, Kohler, & Hallinen, 2009).

# Types of Evaluation Questions

- You may choose to focus on *process* questions, *outcomes* questions, or both (examples on pp. 4-5).
- Our emphasis is upon curriculum evaluation *for improvement of student learning*.



## Who Should Be Involved?

Through these processes, all team members will be able to individually and collectively analyze and interpret evaluative data. Early on, specific roles will be established; for instance, a particular team member might be most responsible for collection of data, or of certain types of data. If desired, institutional researchers and specialists (e.g., those at the Pathways Resource Center and Office of Community College Research and Leadership) may be consulted to play significant roles in helping the team through these processes. Readers are referred to OCCRL's Team Leader Guide (Jones & Bragg, 2014), which contains an abundance of information about forming and leading teams to support PTR Processes. As well, the Strengthening Partnerships (Nicholson-Tosh & Kirby, 2013) guide might contain helpful information.



# The Challenges of Evaluation, and How to Overcome them (pp. 10-11)

- Conducting evaluations is both important and challenging, for a few reasons:
  - Evaluation inevitably entails rendering value judgments/appraisals about some object/topic of focus, and this reality can make some people nervous
  - Several tips are offered in terms of maximizing the utility of evaluations while minimizing issues stemming from politics



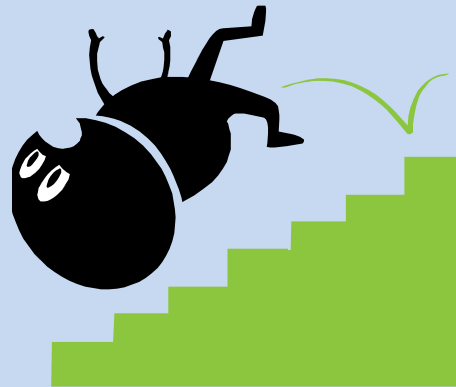


# Steps at a Glance

- **7 steps** in total
- **Part 1: Planning for Evaluation (5 steps)**
- **Part 2: Implementing Evaluation (2 steps)**



Vs.



Step 1

**Step 1:** Identify and Begin to Develop  
Primary Questions about the Curriculum  
and Associated Context

**Overarching questions:** Is it the curriculum? If so, what in particular do we wish to know about it?

**Special Notes:**

- **Appendix C** will help your team wade through the overarching questions above
  - *Note:* It is possible your team will conclude that its current focus is elsewhere.
- **Appendix D** includes links to, and descriptions of, a set of resources and considerations specific to STEM
  - Numerous frameworks and guides are available to help teams define what constitutes high quality curriculum in a given area, and clear definitions are key to a successful evaluation.
  - The PRC/ISBE Program of Study Self-Evaluation instrument could also be quite useful



Step 1

Step 1: Identify and Begin to Develop Primary Questions about the Curriculum and Associated Context

Self-Assessment Instrument  
(available on our website)

**2. PARTNERSHIPS**  
*Component:* Ongoing relationships among education, business, and other community stakeholders are central to POS design, implementation, and maintenance.  
*Subcomponents:* Collaborative partnerships should:

- Create written memoranda of understanding that elaborate the roles and responsibilities of partnership members.
- Conduct ongoing analyses of economic and workforce trends to identify statewide (or regional) POS to be created, expanded, or discontinued.
- Link into existing initiatives that promote workforce and economic development, such as sector strategies and other activities supported by the Workforce Investment Act.
- Identify, validate, and keep current the technical and workforce readiness skills that should be taught within a POS.

Indicators of Effective School District Practices	Current Status
A. Partnership members are thoughtfully selected and a Memorandum of Understanding (MOU) is created that articulates each partner's roles and responsibilities.	<input type="checkbox"/> In the Planning Stages <input type="checkbox"/> Partially Implemented <input type="checkbox"/> Fully Implemented
B. Labor market analyses are conducted to determine local, state, and regional forecasted workforce demands for the program of study. Resources of Pathways Resource Centers, Learning Exchanges, and other initiatives are accessed to assist with POS identification. Student interests in the POS are also assessed.	<input type="checkbox"/> In the Planning Stages <input type="checkbox"/> Partially Implemented <input type="checkbox"/> Fully Implemented
C. The partnership assumes some ownership of POS development, working with educational leaders to implement a high quality POS that is accessible to all students.	<input type="checkbox"/> In the Planning Stages <input type="checkbox"/> Partially Implemented <input type="checkbox"/> Fully Implemented
D. Partner expertise is utilized to ensure the POS is rigorous, relevant, and aligned with technical and workforce readiness skills.	<input type="checkbox"/> In the Planning Stages <input type="checkbox"/> Partially Implemented <input type="checkbox"/> Fully Implemented
E. Identified partners are willing to work with students in some valuable capacity, relative to work experience, job shadowing, and mentoring of careers related to student interests. Specific student opportunities should be identified.	<input type="checkbox"/> In the Planning Stages <input type="checkbox"/> Partially Implemented <input type="checkbox"/> Fully Implemented
<b>Our overall current status for Component 2 Partnerships is:</b>	<input type="checkbox"/> In the Planning Stages <input type="checkbox"/> Partially Implemented <input type="checkbox"/> Fully Implemented

Our next steps are (include timeline to complete each step):

EXAMPLE



Step 2

Step 2: Prepare for the Evaluation

**Overarching questions:** What (more specifically) do we need to find out? Who will be part of this discovery process?

**Substeps:**

2a: Setting Project Parameters

2b: Selection of a project director and assignment of additional roles

2c: Preparing Background evaluation documents

**Special Notes:**

- At this point, it may be helpful to visualize a skeleton of the sections that a completed evaluation will likely include. See **Appendix F** or template available on PRC website.
- Likewise, **Appendix G** contains links to completed evaluations from the field.



Step 3

Step 3: Assess the Context

**Overarching question:** What aspects of our context have noteworthy impact upon our program of study curriculum?

Questions at this stage should include a focus upon relevant aspects of context in the following areas (Glatthorn et al., 2012):

1. Attitudes, values, and expectations of the community
2. Significant aspects of the institution that impact the program of study: size, organizational structure, leadership, funding resources
3. Special characteristics of school facilities that are relevant
4. Special characteristics of the student body that are relevant (background characteristics, aptitudes, interests, etc.)
5. Special characteristics of the faculty that are relevant (experience, values, background, collaboration).

Upon completing this step, the team will have highlighted pertinent contextual factors that impact the program of study curriculum, including particular learner needs.



Step 4

Step 4: Establish the Evaluation Focus and Questions

**Overarching questions:** What will be our evaluation focus? What, specifically, will be our evaluation questions?

**Special Notes:**

- It is important to consider several aspects of the curricula: the supported, the taught, the assessed, and the learned.
- Establishing the scope and limits of the evaluation is critical. Find the sweet spot.
  - Examples are provided on p. 21
  - Evaluating against standards is common, practical, and helpful. See **Appendix D**. Alternatively, an evaluation team will need to identify and rely upon its own internal standards.
  - Once a team has established its focus, next it should translate/convert it into specific, answerable evaluation questions.



Step 4

Step 4: Establish the Evaluation Focus and Questions

*(continued)*

For instance, suppose that a team has chosen to focus upon the **work-based experiences** afforded to students. Its next task was to convert this focus into specific questions. Upon doing so, the team has come up with the following:

1. What is the quality of work-based experience afforded to students?
2. How many students are currently afforded work-based experiences, and how does this compare to the expressed demand by students for such experiences?
3. What are the work-based experiences that are currently offered, and how does this list of experiences compare to the demand by students and the supply of potential local work-based learning opportunities?
4. What are the benefits experienced by students and/or by work partners?



### Focus on STEM

With respect to STEM education, inquiry or problem-based learning may take on a heightened importance. Roberts (2013), in fact, provides an 8-step model of how STEM should be implemented in a problem-based fashion, to promote student learning:

1. Select a central standard
2. Align the standard with a relevant societal problem
3. Support the lesson by matching with STEM standards
4. Instruct according to the content standards
5. Engage students in design and development of a solution to the problem
6. Troubleshoot by identifying and correcting problems
7. Evaluate by ensuring that students and teachers identify and fix the problem
8. (Students) Present the results

Of course, other models exist. The point is that models such as these might provide a focus and a foundation for an evaluation of STEM curricula and programming.

As well, the goal of cross-curricular integration of STEM programming (e.g., the integration of math and science education) is a common and worthy goal (Stohlmann, Moore, & Roehrig, 2012). An evaluation could be focused around the question of the degree to which desired integration is occurring, and might likewise be aimed to generate recommendations for improvement in this area.





### Qualitative and Quantitative Data

Quantitative Data is numerical in nature, and might include:

- Student achievement (e.g., test scores or grades)
- Survey results – rankings or ratings
- Participation and/or attendance data
- College enrollment, attrition, completion, and placement
- Rates of homework completion
- Graduation rates
- Structured observational data (e.g., counts of participation, etc.)
- Students needing development coursework in postsecondary institutions

Qualitative data is descriptive and often conveyed in narrative form, and might include:

- Case study information (e.g., regarding curriculum intentions in relationship to actual implementation)
- Interview or focus group analysis
- Unstructured observations of classrooms and student learning experiences
- Open-ended survey responses
- Analysis of student written work

Source: Adapted from Curriculum Management Plan, Rockwood School District Curriculum Department, 2013



Step 5

Step 5: Complete the Evaluation Design

**Overarching question:** *For each of our questions, what data will we need, how will we collect it, and how will we analyze it? Also, who will be responsible for which tasks?*

**Special Notes:**

- Appendices H and I are tables which demonstrate organized approaches for identifying and rerecording detailed planning information
  - Associated templates are available at  
[http://pathways.illinois.edu/?page\\_id=818](http://pathways.illinois.edu/?page_id=818)

*The design is now finalized, and it is time to carry it out to its completion!*



Step 5

Step 5: Complete the Evaluation Design

*(continued)*

APPENDIX I  
EVALUATION QUESTIONS, METHODS, AND ANALYTICAL  
APPROACHES

Table 1. Evaluation Questions and Data Collection Methods

Evaluation Question	Data Collection Method(s)	Source of Data
1.		
2.		
3.		



Step 6

Step 6: Carry Out the Design

**Overarching question:** *Can we deliver on our evaluation, overcoming any obstacles we encounter?*

**Special Notes:**

- The project director has an important leadership and coordination function at this time. The director also has the primary responsibility of integrating Information into a coherent whole.



Step 7

Step 7: Develop and Present Findings, Recommendations, and Action Plan

**Overarching questions:** In light of the data we have gathered, what are our key findings? How can we best share and disseminate the results? Who will be responsible for sharing results?

**Special Notes:**

- the project director (in collaboration with the evaluation team) will be responsible for integrating the information into a set of findings.
  - These findings should relate back to the evaluation purpose, and will invariably include identification of strengths and improvement areas.
  - Findings should be clearly and simply stated and relate directly to a set of recommendations.
  - Be careful not to overstate; strive to make reasonable statements that are supported by the information obtained.



Step 7

Step 7: Develop and Present Findings, Recommendations, and Action Plan

*(continued)*

Exhale for a moment and celebrate.

*Two final considerations are as follows:*

1. How will the team share and disseminate the results?
2. Will part or all of the team, or will some other entity, be responsible for converting the recommendations into changes and action steps? The team should consider how to most effectively participate in this process. This will include a careful consideration of the key stakeholders, and what their needs will be in relation to the findings and recommendations.



# Wrap Up

- Pathways Resource Center will gladly support RttT educators as they contemplate, or engage in, curriculum evaluation.
- Questions?

