

Guiding Framework for Planning, Gathering, and Using Evidence: The Design-Implementation-Outcomes (DIO) Cycle of Evidence

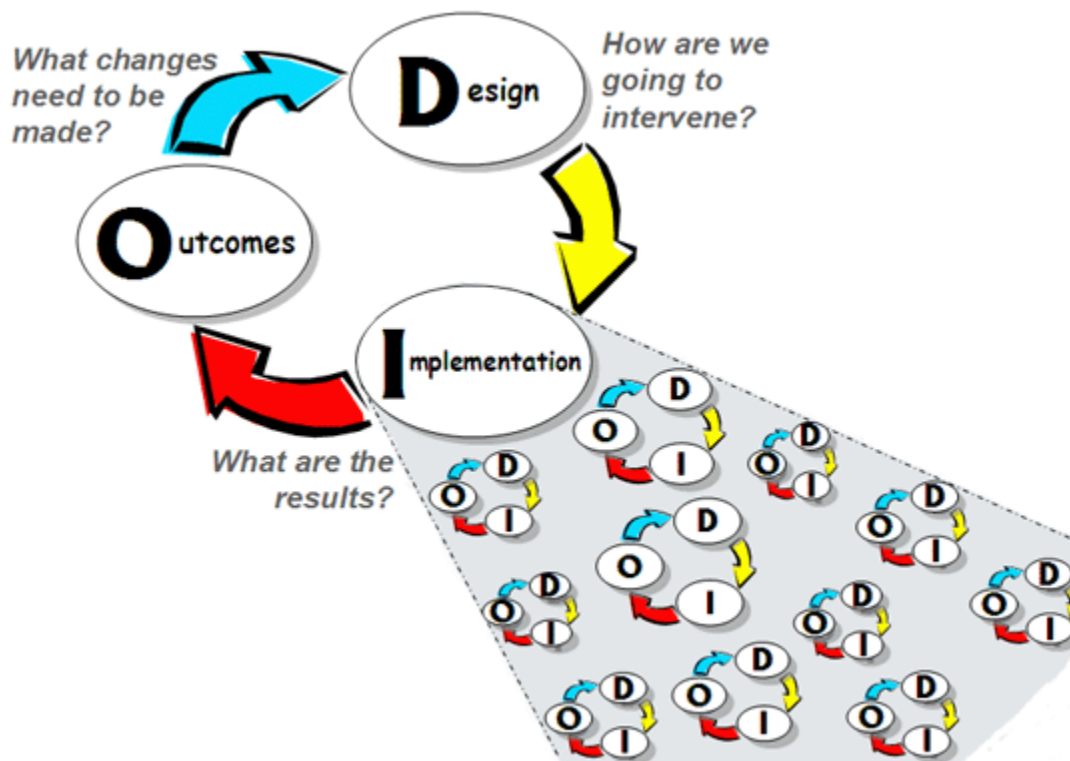
While various research methods, evaluation models, and tools exist to help plan for and gather high quality evidence, high levels of expertise may be required to understand and apply them. Yet, in this time of increased accountability, project designers, implementers, and decision-makers who may be less familiar with evaluation are often responsible for gathering and using evidence throughout the life of the project. The DIO Cycle of Evidence was developed to fill a gap—the gap between experienced evaluators who routinely use evaluation models and tools, and STEM faculty and professionals who are often competent researchers but who have less familiarity with educational evaluation, yet are responsible for evaluations of MSP projects that they plan and implement. The DIO Cycle of Evidence bridges the gap by providing a framework that guides thinking about the design and implementation of evaluation activities, within the context of a research and development cycle and using language not specific to evaluation.

In short, the DIO Cycle of Evidence provides a simple yet rigorous framework for defining the evidence needed to adequately evaluate the design, implementation, and outcomes of a project, or activities conducted within a project. Specifically, it:

- guides planning for and gathering evidence for decision making to help guarantee that MSPs will produce valued outcomes, and to confirm those outcomes.
- prescribes use of valid and reliable evidence to inform the three Design-Implementation-Outcome phases and to make changes and improvements as indicated by the evidence.
- helps prioritize evidence gathering.
- establishes a common language for project personnel, evaluators, and stakeholders to communicate.
- depicts the cyclical nature of designing, implementing, analyzing outcomes, and revising and refining project activities based on those outcomes.
- reminds us that gathering and using evidence is not just an evaluator's responsibility; it is also the responsibility of project designers, implementers, and decision-makers.

The DIO Cycle of Evidence is not an evaluation model. There are many existing evaluation models, and although the DIO Cycle of Evidence phases are congruent with various evaluation models, its main purpose is to guide thinking about, planning for, and gathering evidence. (See the section on “Relationship of the DIO Cycle of Evidence to Other Frameworks” for more information on how the DIO Cycle of Evidence relates to the components of a typical evaluation plan and to logic models.)

As shown in the following figure, the DIO Cycle of Evidence consists of three distinct phases for carrying out and evaluating (a) a project as a whole or (b) specific activities within a project.



While each of the phases will be discussed separately in successive sections, we will point out here that the Implementation phase can involve numerous smaller DIO Cycles of Evidence, with each cycle applied to individual activities within a project, and linked as necessary such that the outcomes of one or more smaller DIO Cycles of Evidence may serve as inputs into other DIO Cycles of Evidence.

Projects may not have sufficient funds to plan for and gather evidence for all of these “mini” DIO Cycles of Evidence, but “key” or major mini-cycles should include evidence-gathering to document effectiveness and to provide evidence that the outcomes of major activities can be attributed to specific preceding activities.

The following pages describe the phases and list specific guiding questions for each phase once the design, activities to be implemented, and outcomes are articulated. Again, this cycle can be applied at many levels—to the overall “global” or “big picture” view of a project, to related groups of activities (e.g., various types of professional development activities all designed to change teacher knowledge and behaviors), or to individual activities.

In all three phases of the DIO Cycle, Design-Implementation-Outcomes, three important questions should be asked along with the questions specific to each phase:

- What EVIDENCE do you need?
- How would you collect the EVIDENCE?
- When does the EVIDENCE need to be collected?

DESIGN

The DESIGN phase is initiated in response to the question, “What problem(s) need to be solved?” Prior to designing a project or activity, a need must be established or problem identified—based for example, on the current state of mathematics and science education. Once a need has been established, the DESIGN phase addresses the overarching question, “How are we going to intervene?”

The DESIGN of a project or activity must be based on evidence that

- Supports the need for the project as well as the design’s validity and feasibility,
- Confirms that alternative designs were considered or attempted,
- Indicates that the needs of stakeholders have been addressed, and
- Shows that contextual factors guided decisions about design.

The following questions should guide project or activity DESIGN and can be used as a checklist to provide a comprehensive framework for gathering evidence during the DESIGN phase of a project or activity. To justify the DESIGN of a project or activity, each question should be answered with appropriate evidence supporting the answer.

1. What evidence supports the need for project activities?

- What are the priority needs and opportunities?
- What evidence was used to establish these needs or problems?

2. How are we going to intervene?

- What activities will be planned to bring about change?
- By what mechanisms (i.e., causal links) will these activities bring about change? What is the program theory or logic model for the design of the project and project activities?
- Are project activities aligned with project goals? With funding agency goals? With stakeholder goals?
- Do project activities link to planned outcomes?
- Is there evidence that the design will solve one or more existing problems or meet established needs?
- What alternative designs have been tried or could be implemented to address the established need or solve the problem?

3. What evidence is needed to show the design is valid?

- Is the design supported by relevant research or theory (e.g., published and unpublished reports of studies, descriptions of theory, findings from pilot studies)?
- If not, how will the validity of the design be justified?
- What evidence shows that project outcomes have practical importance?
- Is there evidence that the design will contribute to the knowledge base in meaningful ways?

4. What evidence is needed to show that the needs of different stakeholder groups have been considered?

- To what extent have the needs of underrepresented groups been considered?
- To what extent do the values of stakeholder groups differ? How will these differences affect the implementation of project activities?
- How will differing values affect interpretation of the evidence for the design?
- What evidence is needed to justify the design to identified audiences or different stakeholder groups? How will the evidence be communicated to various audiences/stakeholders?

5. What evidence is needed to document the contexts within which the project and its activities will operate?

(For additional information, see the section “Role of Context in Establishing Evidence.”)

- What political, social, cultural, or historical factors, values, or characteristics of this setting—including characteristics of schools, teachers, and students—need to be considered?
- To what extent will contextual factors affect project design, implementation of activities, or outcomes?
- What alternative designs need to be considered to account for varying contexts?

6. What evidence is needed to show the design is feasible?

- Can activities based on the project design be accomplished in the given time frame with the given resources (e.g., money, people, skills) within the given context?
- What changes in the context (e.g., changes in elected officials, policies, other sources of funding, community values, etc.) could affect the feasibility of the design?

Remember, in addition to each question listed above that frames the evidence needed for the DESIGN phase, ask

- How will you collect the evidence?
- When does the evidence need to be collected?

IMPLEMENTATION

The IMPLEMENTATION phase of a project occurs when project activities are carried out in a particular context. Within the IMPLEMENTATION phase, there may be a single DIO Cycle of Evidence or many, potentially interrelated DIO Cycles where the outcomes of one or more DIO Cycles link to subsequent DIO Cycles. Identifying these links and gathering evidence to validate the links are crucial to determining overall project impact. In other words, outcomes of one or more activities may be needed as evidence to establish the design and implementation of other activities, or certain outcomes of one activity may be needed to trigger the start of other activities. The evidence gathered throughout a DIO Cycle of Evidence can impact activities defined by another DIO Cycle, and if outcomes do not meet expectations, the evidence may suggest that mid-course corrections are necessary. These inter-relationships are usually delineated in a project’s logic model or theory of action. (See the section on “Relationship of the DIO Cycle of Evidence to Other Frameworks” for more information.)

The IMPLEMENTATION of a project or activity must be based on evidence that

- Demonstrates that project activities have been implemented as planned,
- Explains the degree to which activities were implemented (i.e., implementation fidelity),
- Documents that outcomes of activities were used to guide changes and improvements,
- Confirms that decision-making and mid-course corrections were based on valid data, and
- Identifies contextual factors that could affect implementation in this or other settings.

The following questions should guide project or activity IMPLEMENTATION and can be used as a checklist to provide a comprehensive framework for gathering evidence during the IMPLEMENTATION phase of a project or activity. To justify the IMPLEMENTATION of a project or activity, each question should be answered with appropriate evidence supporting the answer.

1. What evidence is needed to determine if project activities are carried out as planned?

- Is the project/activity being implemented on schedule? Within budget?
- What evidence is needed to determine implementation fidelity—the degree to which projects/activities were implemented as planned?
- How will decisions be made about how much and what kind of evidence to gather (i.e., defining evaluation priorities)?

2. What evidence is needed to document successes, challenges, and lessons learned? What evidence is needed to document decisions that were made to change implementation of project activities or make mid-course corrections?

- What factors appear to promote successful implementation of project activities?
- What barriers hinder implementation of project activities?
- What evidence is needed to document deviations to planned implementation? On what evidence were decisions to change planned implementation based? How valid is that evidence?
- What lessons have been learned during implementation of project activities?

3. What evidence is needed to document characteristics of the context, including characteristics of participants, stakeholders, partnerships?

(For additional information, see the section “Role of Context in Establishing Evidence.”)

- Within what contexts were project activities actually implemented? To what extent did these contexts affect implementation?
- What are the characteristics of participants, stakeholders, partnerships?
- Have contexts/characteristics changed over the course of the project? What accounts for these changes?
- What aspects of the context/characteristics might affect outcomes?
- Can others use information about implementation of project activities to conduct similar activities to produce similar outcomes in their contexts?

Remember, in addition to each question listed above that frames the evidence needed for the IMPLEMENTATION phase, ask

- How will you collect the evidence?
- When does the evidence need to be collected?

OUTCOMES

The OUTCOMES phase of a project occurs when project activities have been carried out within a particular context and their impact is determined. Within the OUTCOMES phase, data are analyzed to determine (a) if project/activity goals were met, (b) the results or impact of the project or activities, (c) anticipated or unanticipated side effects, and (d) what changes need to be made in DESIGN for successive IMPLEMENTATIONS.

The **OUTCOMES** of a project or activity must be based on evidence that

- Demonstrates that project or activity goals were reached,
- Shows the extent to which outcomes can be attributed to specific project activities (rather than competing events), and
- Confirms that project/activity outcomes are reliable, valid, cost-effective, and important.

The following questions should guide analysis and interpretation of project or activity **OUTCOMES** and can be used as a checklist to provide a comprehensive framework for considering evidence during the **OUTCOMES** phase of a project or activity. To justify the **OUTCOMES** of a project or activity, each question should be answered with appropriate evidence supporting the answer.

1. What evidence is needed to determine if anticipated outcomes were achieved?

- In what ways have beginning states been altered in addressing the need or solving the problem? Are these changes sustainable?
- What evidence is needed to demonstrate the extent to which outcomes are reliable and valid?
- What evidence shows that the needs of underrepresented groups have been addressed?
- What evidence establishes sustainable changes in MSP Key Features: teacher quality, quantity, and diversity? Student access to and success in challenging courses and curricula? Partnerships? Changes in higher education and STEM faculty? Institutionalization?

2. What evidence demonstrates project/activity goals were reached on time and within budget?

- What evidence documents that project/activity goals were reached on schedule and within budget?
- What evidence shows why achievement of goals was delayed or not reached?
- What evidence documents why achievement of goals resulted in additional expenses?

3. What evidence is needed to demonstrate the extent to which activity or project outcomes can be attributed to specific project activities?

(See the subsequent section on “Logic Models”)

- What evidence supports the link between project activities and project outcomes?
- What competing events or confounding factors could have explained or affected activity/project outcomes?
- What gaps or weaknesses in evaluation evidence preclude drawing strong conclusions about the relationships between activities and outcomes?

4. What aspects of (a) activity or project design, (b) implementation of activities, or (c) evaluation need to be redesigned based on the outcomes, and what evidence is needed to support these changes?

- Were the outcomes expected? Was enough evidence gathered to be able to demonstrate that outcomes were as expected?
- If not, what changes will be made to the design and implementation of activities to achieve expected outcomes? What additional evidence needs to be gathered?
- Will modifying the existing design help or will a new design be needed?
- What evidence will be needed to document changes, improvements, or mid-course corrections?

5. What evidence is needed to support replication of the project/activities to achieve similar outcomes in other contexts?

(For additional information, see the section “Role of Context in Establishing Evidence”)

- In what ways can the outcomes contribute to the knowledge base?
- Can other people use project findings and publications to conduct to conduct similar projects in their contexts? How might outcomes differ in other contexts?

Remember, in addition to each question listed above that frames the evidence needed for the OUTCOMES phase, ask

- How will you collect the evidence?
- When does the evidence need to be collected?

How and When to Gather and Use Evidence

It is not enough to identify what evidence needs to be gathered. When and how evidence will be gathered, as well as how reliability and validity of the evidence will be established, must also be articulated. The following points can guide planning, gathering, analyzing, and reporting evidence.

- Identify the sources of evidence and the requisite time frame for evidence gathering.
- Identify appropriate methods and instruments.
- Identify evidence that exists or is needed to establish reliability and validity of instruments and other devices or processes used to gather evidence.
- Identify how the evidence will be managed and analyzed.
- Plan how the results will be reported and used.

Tables such as those on the following pages can help identify and organize evidence that is needed. The examples show evidence that might be gathered in each phase of the DIO Cycle of Evidence for a new teacher induction and retention model which includes mentoring for new teachers. The activity (as one component of a larger project) and the evidence needed address the MSP Key Feature, Teacher Quantity, Quality, and Diversity.

Not all sub-questions for the Design, Implementation, and Outcomes phases are included in the following tables, but all main and sub-questions should be considered and their answers justified in planning and gathering evidence. In particular, sub-questions about instrument reliability and validity and quality of evidence are not addressed in the tables, but must be considered in planning, gathering, and analyzing evidence.

This document does not include information about how to analyze evidence or report results. However, USE of results to guide data-based decision-making and support mid-course corrections is an important component of the DIO Cycle of Evidence.

Analysis of evidence for projects as large and complex as MSP projects is beyond the scope of this document. However, the MSP-RETA project at the University of Wisconsin-Madison offers technical assistance to (a) increase the knowledge of design, indicators, and conditions needed to successfully measure change in student learning over time, (b) provide useful tools and designs for evaluators to attribute outcomes to MSP activities, and (c) apply techniques for analyzing the relationship between student achievement and MSP project activities to evaluate the success of MSP projects. Learn more about the “Adding Value to the Mathematics and Science Partnership Evaluations” project at <http://www.wcer.wisc.edu/addingvalue/Project%20Mission/Project.htm>.

Many resources are available to guide reporting of evaluation results and to make evaluation findings meaningful to stakeholders (see Gangopadhyay, 2002; Miron, 2004; Patton, 1006; Torres, Preskill, & Piontek, 2005).

Evidence Gathering Matrix: DESIGN Phase of a Hypothetical MSP's New Teacher Induction and Mentoring Model

DESIGN Questions	Evidence	Sources	Methods	Timeframe	Instrument(s)
What evidence supports the need for project activities?	Poor retention during first 3 years of teaching	District records	Review of records	Prior to writing MSP proposal	Not Applicable (NA)
	Positive impact of more experienced teachers on student outcomes	Published research	Literature search and review	Prior to writing MSP proposal	Coding sheet of study characteristics*
How are we going to intervene? What evidence is needed to show the design is valid?	Positive impact of new teacher mentoring models on teacher retention leading to more experienced teachers	Published research	Literature search and review	During writing of proposal	Coding sheet of study characteristics*
	Positive impact of the new teacher mentoring model on retention, with less impact (but still positive) of alternative retention model designed to increase content knowledge	Data from pilot test conducted during first year of project funding	Surveys, interviews of new teachers and mentors in pilot district, new teachers in comparison districts	First year of project during which pilot study is implemented	--Surveys, interview protocols developed during pilot study --NAEP Teacher Questionnaire
What evidence is needed to show that the needs of different stakeholder groups have been considered?	Positive impact of mentoring models on retention of teachers from underrepresented groups	Published research	Literature search and review	Prior to writing MSP proposal	Coding sheet of study characteristics*
	Reasons teachers from underrepresented groups exit system	Data from exit interviews	Review of existing data	Prior to writing MSP proposal	NA
	District/school support for implementation of mentoring model	District/school administrators	Letter of support	Prior to writing proposal	NA
What evidence is needed to document the contexts within which the project and its activities will operate?	District, school, teacher, and student characteristics **	--Existing data from district/school records --Existing school culture & climate data	Review of existing data	Prior to writing proposal for MSP funding and during first year of project	NA
What evidence is needed to show the design is feasible?	--Costs in terms of time, personnel expertise, expenses --Context descriptions	Districts who have implemented similar models	Interviews with district administrators	Prior to writing proposal for MSP funding	Interview protocol

* includes reference, study design, sample size, description of intervention, magnitude of impact, rating of study quality, etc.

** including policies about release time for mentoring activities, ethnic percentages of teachers and students, perceptions of administrative support, etc.

Evidence Gathering Matrix: IMPLEMENTATION Phase of a Hypothetical MSP's New Teacher Induction/Mentoring Model

IMPLEMENTATION Questions	Evidence	Sources	Methods	Timeframe	Instrument(s)
What evidence is needed to determine if project activities are carried out as planned?	Changes to project scope and sequence, budgets, personnel	Project documents (e.g., timelines, budget, reports)	Document review	Throughout project	NA
	Number of mentors trained during in-service	Attendance lists for mentor in-service	Document review	Upon completion of in-service	NA
	Activities between mentors, new teachers	Logs of activities between new teachers, mentors	Document review	Throughout school year	Activity log
	Level of support for mentoring model	Administrators, mentors, new teachers	Interview	Every 3 months during school year	Interview protocol
What evidence is needed to document successes, challenges, and lessons learned? What evidence is needed to document decisions that were made to change implementation of project activities or make mid-course corrections?	--Successes --Challenges to implementation, barriers, problems encountered --Problem solutions	--Project documents (e.g., reports, memos, minutes of meetings, email messages, attendance lists) --Teacher mentors and mentees	--Document review --Opinion surveys	--Throughout project and when writing annual/final reports --Annually in spring	--NA --Questionnaires for mentors, mentees
	--Changes to planned activities, timelines, budgets, personnel --Poor outcomes of implemented activities	Project documents and data	--Document review --Data analysis	Throughout project	NA
What evidence is needed to document characteristics of the context, including characteristics of participants, stakeholders, partnerships?	Legislation; state, district, & school policies; district, school, teacher, student, higher ed faculty, & project personnel characteristics; local events	Government documents, district & school records, newspapers, project documents (see above), vitas of project staff & participants	--Document review --Data analysis	Throughout project and when writing annual/final reports	NA
	Characteristics of district/school personnel	District/school administrators, staff, participating teachers	Surveys of contextual characteristics	Beginning and end of school year	e.g., NAEP Teacher Questionnaire
	Characteristics of partnerships	MSP personnel, higher ed faculty, district/school administrators, teachers	Surveys of partnership characteristics	Beginning and end of school year	e.g., instrument developed by MSP-RETA project

Evidence Gathering Matrix: OUTCOMES Phase of a Hypothetical MSP's New Teacher Induction and Mentoring Model

OUTCOMES Questions	Evidence	Sources	Methods	Timeframe	Instrument(s)
What evidence is needed to determine if anticipated project outcomes were achieved? On time and within budget?	Teacher attitudes, characteristics	Mentors, mentees	Opinion surveys	Annually in spring	--Questionnaires --NAEP Teacher Questionnaire
	Changes in teaching practices	Mentees	--Classroom practices survey --Classroom observation	Annually in spring	--Questionnaire --Observation protocol
	Retention data	District records	Document/data review	Annually in fall of successive school years	NA
	Reasons for exiting	Teachers leaving system	Interview	Upon contract non-renewal, leaving position	Exit Interview developed by state department of education prior to MSP
	Impact on student outcomes	Students	Testing	Annually in spring	Standardized or state criterion-referenced tests
	Changes to planned activities, timelines, budgets, personnel	Project documents	--Document review --Data analysis	Throughout project	NA
What evidence is needed to demonstrate the extent to which outcomes can be attributed to specific project activities?	Analysis of other activities/events which may affect outcomes	Documents and data addressing contextual factors	--Document review --Data analysis	End of activity cycle or end of project	NA
What aspects of (a) activity or project design, (b) implementation of activities or (c) evaluation need to be redesigned based on the outcomes, and what evidence is needed to support changes?	--Poor outcomes, poor data --Challenges to implementation --Costs too high (any aspect including personnel) --Activities/outcomes not sustainable --Needs of under-represented group not met, etc.	Project documents, data	Ongoing data analysis	Throughout project	NA
What evidence is needed to support replication of the project/activities to achieve similar outcomes in other contexts?	--Contextual characteristics --Description of implementation	Project documents, data	Final project report, other reports	End of activity cycle or end of project	NA