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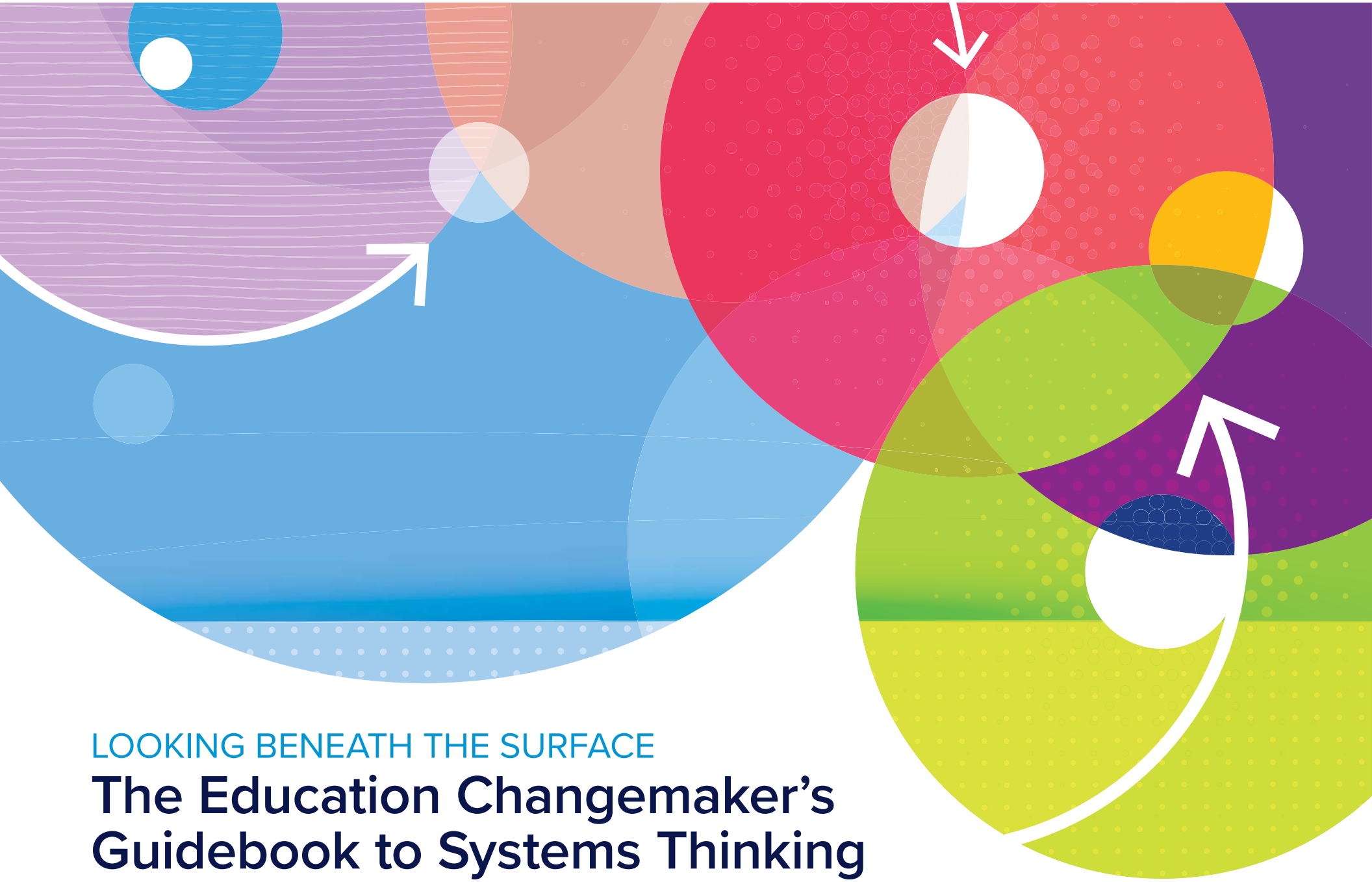
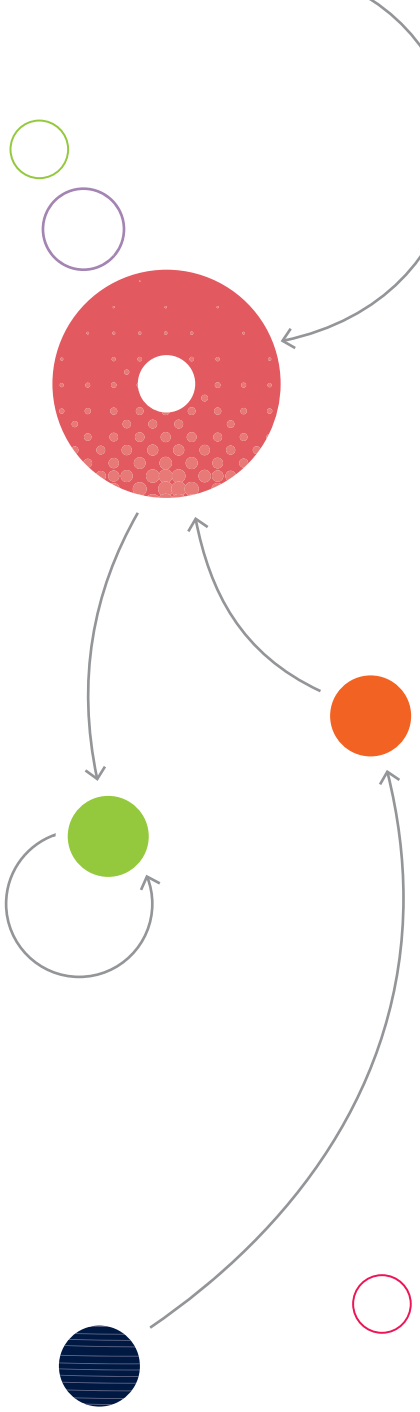


LOOKING BENEATH THE SURFACE

The Education Changemaker's Guidebook to Systems Thinking



CONTENTS

OVERVIEW

Transformation can feel as if it happens in an instant: a surge of leadership and public will or an external event can shift the ground beneath us. However, whether we experience lasting, positive transformation, a return to status quo or a different, less-desirable future depends on what we do next. Aligning our society and our systems with our highest ideals requires iterative, deliberate and non-linear work. It involves analyzing a situation, taking action, reflecting on feedback and outcomes, taking revised action and repeating the process over and over again in close collaboration with others. Systems transformation requires seeing a need and an opportunity for change and then sustaining effort over time, even after the initial swell of emotion and momentum has waned.

Systems thinking can be a powerful element of systems transformation, no matter whether we decided to pursue change or it was thrust upon us. Systems thinking is a set of theories, tools, language and mindsets that can help us grapple with the complex and interconnected world around us and make visible our own perceptions of how it works. Ultimately, it can help us deepen our understanding of what stands between us and our aspirational visions and articulate what it might take to bring those visions to reality.

Our dreams of equitable, joyful, life-affirming and meaningful learning experiences for every child can feel achingly distant during challenging times. But those dreams serve as our touchstone as we navigate uncertainty. We must remember where we want to go because, when everything seems to be changing, we have some power to direct that change.

This guidebook supports such an effort. It introduces a set of systems thinking tools to help education stakeholders gain insight into the systems to which they belong and identify how they might foster change. The content and exercises in this guidebook draw upon the deep and established field of systems thinking and adapt a subset of its methods for use by education changemakers.

Creating change in any domain, particularly one as complex as education, is challenging. However, with the help of systems thinking, we can begin to see our education systems in new ways. Embarking on a systems thinking journey can help us expose what is often unseen, articulate what usually goes unsaid and set our sights on sustainable and meaningful change.

> *When we try to pick out anything by itself, we find it hitched to everything else in the Universe.*
>
> **John Muir**

UNDERSTANDING SYSTEMS

Systems thinking is a professional field and a way of thinking that focuses on understanding how systems are organized, why they function the way they do and how to improve the outcomes of systemic behavior. A few rules of systems, which appear below, form the foundation of this discipline and mindset.

A system's behavior is shaped by its structure. People often try to change problematic system behavior by changing the system's individual parts. However, a system's structure – or the way its components are organized and interact – determines its behavior. The way in which classroom activities are set up affects how students participate. The way in which university admissions standards and degree requirements are designed affects how an institution functions. Recognizing that a system's behavior is shaped by its structure deepens our understanding of how a system's behavior comes about and why change efforts may fall short. To transform a system, we must change its structure and not just its parts.

Systems are interdependent, with circular cause and effect. We tend to think about cause-and-effect relationships in a linear fashion and to miss that they are often circular. For example, imagine that a principal and a teacher experience a great deal of conflict in their relationship. That conflict may cause them to communicate ineffectively, perhaps leading them to be passive aggressive or to avoid communicating. The conflict is a cause of their poor communication, but their poor communication then feeds back into and increases their conflict. Circular cause-and-effect relationships – also known as feedback loops – are the engine of systems. They are why so many systems, both natural and human-made, can keep functioning without constant maintenance or intervention. Recognizing those feedback loops allows us to develop a better understanding of how the different parts of a system work together, which in turn allows us to change systems more effectively.

Systems achieve the results they are designed to achieve. We often talk about broken systems. But according to systems thinking theories, the outcomes of a system are not a fluke; they are the result of how the system is structured. Many

What is a system?

Systems are groups of interdependent components that interact to create a complex entity that is more than the sum of its parts. Examples of natural systems include an organism made of separate but interconnected cells or a forest made up of separate but interconnected flora, fauna, air and water.

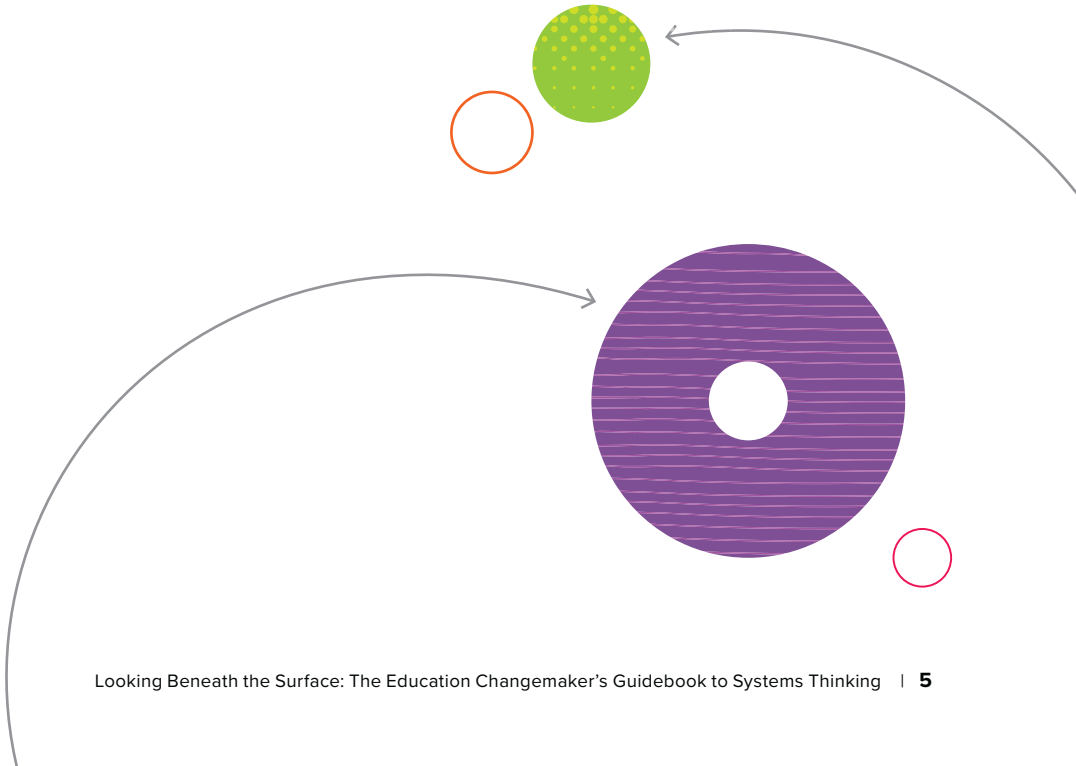
We live among social systems as well. Think about a classroom. It includes a teacher and students. It includes physical objects, such as tables, chairs, windows and walls. It includes policies and procedures, such as behavioral expectations and processes for asking for help. It includes feelings, beliefs and mindsets, such as how connected students feel to one another or how a teacher perceives students' academic abilities. Each component is a relevant part of the system on its own, but none of them exists independently. A classroom is a system because its components interact and affect one another, creating a unique whole. And the classroom is part of many other systems, such as the school campus or the district in which it is situated. The classroom is also part of systems that may seem unrelated to education: it is part of students' family systems, the local economic system and a neighborhood system.

Systems are all around us. We live, learn and work among them. They are ever-present and shape our lived experiences in ways that we often do not comprehend. We are products of systems, and they, of us.

elements of that structure may have been put in place unintentionally or without full knowledge of their consequences, but the interaction of those elements nonetheless helps determine the behavior of the system. For example, a school decides to eliminate recess so that students have more time to spend on academics, but students are struggling to focus. While the school did not intend for students to have trouble attending to their work, that outcome is a result of the way the school chose to structure its system. When we approach problems with a systems thinking mindset, we acknowledge that they are often not solely the result of poor individual decision making or lack of resources, but rather that they are directly related to how the system is organized.

The consequences of actions are not always immediate. Delays often exist in systems, whether in how fast information travels or in how long it takes for the effects of a change to occur. This dynamic means that the consequences of our actions may not be clear right away. The positive outcomes of an effective change effort or the negative consequences of an ineffective one are often delayed. The former situation might mislead us to believe that the change effort is not working as intended, while the latter might mislead us to assume that it is delivering as expected. Thus, delays can create either anxiety and over-adjustment or a lack of concern and under-adjustment. For example, when a school implements a new curriculum, no one knows exactly how long it might take to determine whether it is having the intended effects. Recognizing that delays are present helps us gauge the situation so that we can take the right action at the right time. When possible, shortening delays can help us acquire more timely information to guide our actions.

Mental models underpin systems. Mental models are the values and beliefs that influence how people understand and act in the world. They come from our experiences. Our mental models influence the decisions we make and therefore influence how a system is organized. At the same time, systems shape our experiences and therefore shape our mental models. Mental models are necessary to help us simplify the complex realities in which we live. However, they can cause barriers, especially when they are deep-seated and implicit. They can cause us to become stuck in our thinking, thus preventing us from putting changes into practice and biasing us toward ideas that fit into our existing mental models. For example, a teacher might believe that students are not able to handle discussions about sensitive social issues. That mental model would influence decisions that the teacher would make and would help form the classroom system. Because no mental model is “true,” being mindful of the influence that mental models have on our thinking and our actions is valuable in and of itself.



EMBARKING ON A SYSTEMS THINKING JOURNEY

Embarking on a systems journey entails undertaking a learning journey. Systems thinking tools can help you recognize and address immediate problems occurring within your system, but they can also set the stage for deep and ongoing reflection about the nature of your system, about what is working well and about what the system might become. They can become powerful organizational learning tools. Engaging in systems thinking often requires people to develop new points of view and new ways of working. This guidebook introduces ways of thinking that can help you see challenges, opportunities, causes and effects differently. A few guidelines for how to apply those mindsets in your context appear below.

Approach systems thinking as a mindset, not a checklist. This guidebook offers ideas and practices that could contribute to your change management efforts and that you could integrate into processes you already use. Systems thinking is not by itself a discrete change management tool.[1] Nor is it a step-by-step process to approach systems change. Systems thinking is most powerful when its theories and tools become habits of mind.[2]

Make mental models explicit. Once we recognize that we all have mental models and that they affect our beliefs, our actions and our systems' behavior, we can no longer allow those mental models to remain hidden. Systems thinking offers tools for making mental models explicit, but simple conversation can also uncover how different people see reality, problems, solutions and future opportunities. We must reflect on our own mental models, share them, seek to understand others' and, where possible, align them with the future that we hope to see.

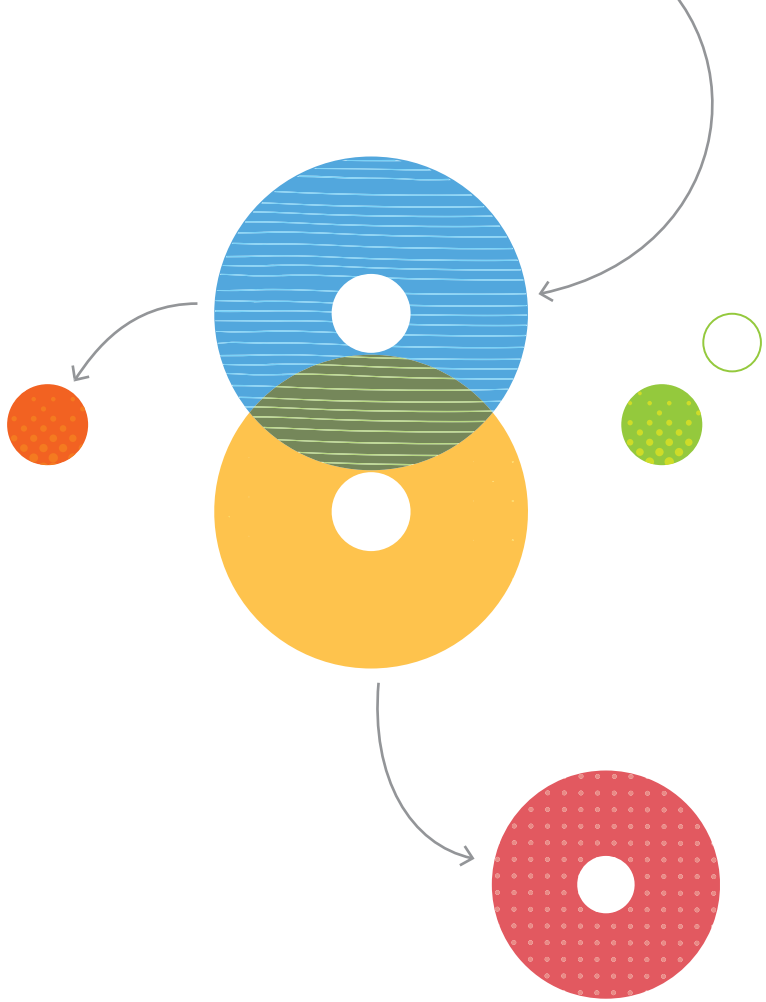
Acknowledge assumptions and make them a centerpiece of problem solving. Part of making mental models explicit is recognizing that we all hold assumptions about the way the world works. Assumptions are people's way of resolving uncertainty; they are the facts that we take for granted without thinking about them. Assumptions form the foundations of our mental models, and they are necessary for us to function in the world. They become problems only when they are invisible, unexamined and treated as truth. When faced with a problem, we need to work to understand our own assumptions and those of others. By encouraging stakeholders to articulate their assumptions, we can clarify the path toward shared understanding and collaboration.

Authentic collaboration is a non-negotiable. If we acknowledge that our view of a system – including its components, the way it operates, the problems we observe and options for improving it – represents only one perspective, we have no choice but to seek out others with different perspectives to try to form a more complete picture. Authentic collaboration involves more than simply inviting different types of people to participate in a conversation. It requires co-designed processes and shared decision-making power that can buffer against tokenism and against using people as means to a pre-determined end.[3] True collaboration requires a willingness to shift perspective and a belief in the value and wisdom of viewpoints and sets of experiences different from our own.

Accept ambiguity and uncertainty. True and objective understanding of a system is not possible because every system has intangible elements and because our lived experiences within systems vary. Similarly, systems problems are complex and do not have singular solutions. Systems thinking can lead to deeper insight, more meaningful collaboration and clearer thinking about the inevitable tradeoffs that any solution could involve. It does not lead to cure-all solutions or to certainty about the path ahead. When we engage in systems thinking, we become more aware of ambiguity and uncertainty, which can be unnerving, but with practice, we can become more comfortable with them, too.

Remember that context matters. Every system is unique, as is its stakeholders' vision of what the system could become. Though the tools of systems thinking can apply to any system, the context and details of each of our systems should guide our decisions and actions. Nothing in this guidebook should be mistaken as a blueprint for, nor a caution against, a particular choice or intervention. The behavior of your system will be specific to it, as will the appropriate and meaningful ways to create change.

Sustainable change requires iteration and ongoing learning. Systems change work is never done. Transformation can happen, but it will never be complete because both the circumstances surrounding any given system and its internal factors keep evolving. This reality can be frustrating. It can also be liberating because it can inspire us to continue to learn, experiment and grapple with the big questions that we must address to align education systems with emerging needs and make them equitable for every learner.



> *Education is so complex. Everything is changing, not only year to year, but every day, for every student and every teacher. The traditional linear tools are not a match for that complexity. Systems thinking gives us tools to wrestle with that complexity more concretely.*[4]
>
> **Allie Simpson, program coordinator – K-12 education**
> **Social System Design Lab**

USING THIS GUIDEBOOK

This guidebook introduces education stakeholders and changemakers to the language and tools of systems thinking for the purpose of informing approaches to systems change. The content is organized into four lessons.

LESSON 1

FRAMING THE FOCUS OF A SYSTEMS PROBLEM

Setting the scope of a systems exploration and identifying systems behavior that stakeholders wish to change

LESSON 2

VISUALIZING THE STRUCTURE OF A SYSTEMS PROBLEM

Drawing the components and interactions related to a problem that stakeholders agree is important

LESSON 3

LOOKING FOR LEVERAGE TO CREATE CHANGE

Identifying possible actions and their potential depth of impact on the systems problem being explored

LESSON 4

ANTICIPATING FUTURES OF A SYSTEMS PROBLEM

Evaluating the effects of various interventions or events on a systems problem and the larger system in which it sits

Each lesson introduces core concepts of systems thinking, and the lessons build upon one another. One hypothetical example about a group of education stakeholders working through a shared systems problem is woven through the lessons. This example aims to illustrate concepts and processes introduced in each lesson, not to propose solutions or comment on any school's or community's decisions or approaches. It is based on real-life data and challenges but includes fictional details to clarify opportunities and obstacles that can arise when engaging in systems thinking. Each lesson also includes practice questions and exercises that stakeholders can use to apply the processes, tools and ways of thinking that it describes within different contexts. The guidebook concludes with a list of resources for learning more about systems thinking.

The systems thinking tools and processes presented in this guidebook may seem granular and sometimes tedious. They involve identifying problems, creating diagrams and having uncomfortable conversations. They may seem to be no match for the major challenges that prevent every child from having the learning experiences and supports that they deserve. But those tools and processes provide opportunities to identify novel, non-obvious solutions; to share power and build leadership capacity; to anticipate possible unintended consequences of well-meaning efforts; and even to reframe problems completely. They serve as gateways to new ways of thinking and collaborating, which in turn lead to new ways of being and doing. Systems thinking tools and processes can help groups begin the journey toward transformation.

1 FRAMING THE FOCUS OF A SYSTEMS PROBLEM

Systems thinking helps deepen our understanding of the systems to which we belong. That understanding can help us solve complex and persistent problems in the near-term and engage in ongoing learning and transformational change in the long-term. When a system is not generating a desired behavior, its structure is likely the culprit. However, attempting to get a handle on and change the structure of an entire system at once is frustrating and unproductive, if not impossible. Narrowing in on a systems problem that matters to a range of stakeholders can provide focus for collective efforts. It can also help generate new perspectives on the entire system and surface opportunities for transformation.

Reflecting on the Characteristics of a Systems Problem

Not all problems are systems problems. Some problems can be solved relatively straightforwardly with a new practice, policy or even a conversation. In contrast, systems problems are complex and can be hard to define. Below are the fundamental characteristics of systems problems.[5]

- **Systems problems create uneven ripple effects that may impact the source of the ripple.** In systems problems, causes are effects, and effects are causes. The feedback travels through the system in a circular manner, making the sources of problem difficult to identify.
- **Systems problems change all the time.** Because systems problems have multiple causes and effects, they do not stay constant. A system's behavior may oscillate over time, or it may continuously escalate or decline.
- **Systems problems are perpetuated by the structure of the system.** Well-intentioned people often find themselves as players in systems problems. The way the system is organized can allow certain behaviors and outcomes to continue even when the stakeholders do not intentionally pursue them.
- **Systems problems do not have just one solution.** In a complex system, every action affects other aspects of the system, whether intended or not. Solutions can quickly turn into problems, and even thoughtful and well-executed solutions will have tradeoffs.

The process of identifying a systems problem is specific to each context. However, the general characteristics explored to the right can help sort out which problems need to be addressed at a systems level.

> *We've all heard the old saying that 'if you're not part of the solution, you're part of the problem.' But my systems thinking colleagues turn it on its head and say that 'if you're not part of the problem, you can't be part of the solution.' When you understand that you are part of the system, you understand that you are a part of the problem, and therefore, you can be part of the solution.*
>
> **Daniel H. Kim, founding trustee**
> **Society for Organizational Learning**

EXAMPLE: Reflecting on the Characteristics of a Systems Problem

A small group of teachers and an assistant principal received permission to explore implementing restorative justice practices at the middle school where they worked. Their experience told them that punitive approaches to discipline – namely suspension – were not improving persistent behavior challenges that the school was facing and were negatively affecting the school's culture. The group members were primarily concerned with how the school was suspending students of color at disproportionate rates. However, they worried about making big changes to the school's discipline policies and felt unsure about whether restorative justice would be the best solution. Upon reflecting on their options, they realized that they needed to understand more about the problem that they wanted to solve and that they needed to articulate specifically what they hoped would change. They expanded their group to include additional teachers, students, parents and school and district leaders.

To determine whether they were facing a systems problem, the group members compared the characteristics of a typical systems problem to their circumstances. They agreed that the school's racial disparities in suspension rates were a systems problem.

Could any causes of the problem also be considered effects? Could any effects also be considered causes?
The group agreed that lack of trust and respect among teachers and students was both a cause and an effect of the racial disparities in suspensions. Students of color said that they did not feel that certain teachers respected them, which they acknowledged made them less likely to respect those teachers and their rules and expectations. In turn, that mutual lack of respect increased the chances that the students would engage in behavior that could lead to a suspension. After being suspended, students felt even less respected by the teachers and held less respect for them than they had before.

Has the problem evolved over time?
Everyone agreed that the problem seemed to get worse and would then get better for a while, only to get worse again.

Does the problem seem to persist, even in the face of efforts to solve it?
The group listed many interventions that the school and district had tried, including increased teacher training, new communication protocols for teachers contacting parents and various behavior intervention programs.

Have past solutions led to unintended consequences, or do attempts to implement solutions lead to gridlock because stakeholders cannot agree on the best approach?
Even this group, which had committed to come together to discuss the problem and to work to understand its underlying causes, struggled to agree on what needed to be done and on how to prioritize possible solutions.

Identifying a Shared Systems Problem

When faced with any problem, the obvious first question is, "How can I solve it?" However, asking that question first misses the important work of seeking to understand the complex and interrelated causes that lead to any systems problem. Instead, working to clarify the key features of the problem that are listed below can serve as a useful starting point.

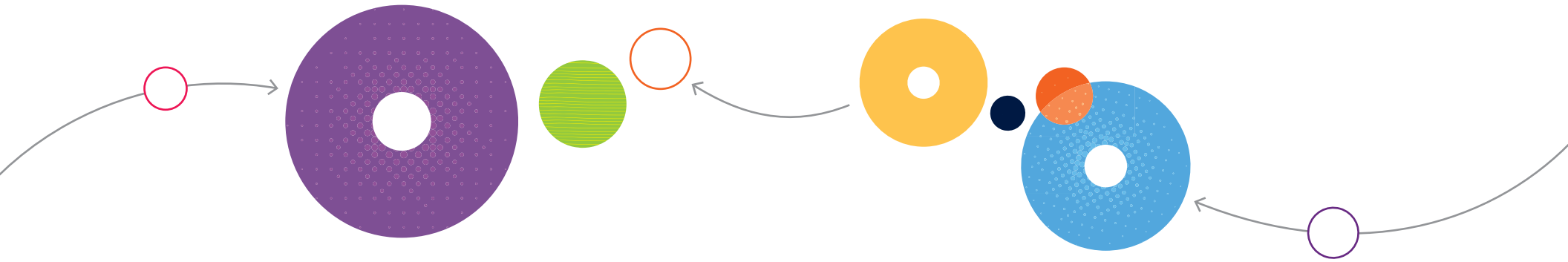
» **What specific systems behavior do people in the system agree is a problem?** Not every tension within a system is a problem to be solved, and not every stakeholder will define problematic behavior the same way. Articulating what is happening in a straightforward, mutually agreed upon way can help surface the core issues.

» **Who has a stake in the problem? Who is contributing to it, and who is affected?** Identifying the players can broaden the conversation about who has a stake in the problem and who has a role in play in the solution. Specifying those people is not about assigning blame or labeling victims. Most players are both contributing to and affected by the problem.

» **What factors are contributing to the problem?** In complex problems, no one factor can be singled out as the cause. Identifying multiple, interconnected contributing factors can deepen understanding of the multifaceted nature of the issue at hand.

» **What is happening as a result of the problem?** Often, people within a system identify a problem and assume that its effects are obvious and commonly understood. However, problems affect stakeholders differently, and some effects may be relatively long-term and difficult to notice. Clarifying what issues or outcomes the problem is causing can expand perspectives about why it needs to be solved.

Exploring these features promotes inquiry into the nature, scope and stakeholders of the problem, which tend to be more complex and less obvious than they may seem to be initially. Identifying a shared systems problem requires thoughtful consideration, inclusive conversation and a willingness to see others' perspectives and priorities.



EXAMPLE: Identifying a Shared Systems Problem

To identify their shared systems problem, the group developed the descriptions below after looking into the data about the problem and having many conversations with others and among themselves. Though those conversations were sometimes uncomfortable, and some people struggled to characterize what was happening because the problem was ongoing, everyone agreed to speak honestly and as specifically as they could about their personal experiences.

The group revised the responses to the questions several times because some people expressed concern that important factors and results had been left out, and others complained that less important factors had been included. Over time, the participants recognized that no one cause or effect was being singled out as "the" reason anything was happening and that no individual or subgroup was being blamed. That recognition allowed everyone to become more comfortable with the responses.

What specific systems behavior do people in the system agree is a problem?
The school issued 42 out-of-school suspensions last year, which was more than other similarly sized schools in the district. While Black students represented 22 percent of the student body, 45 percent of the students suspended last year were Black. The group felt that the school had been over-relying on suspensions for all students, particularly for Black students.

Who has a stake in the problem? Who is contributing to it and who is affected?
Black students; Black parents; White, Latinx and Asian students and parents; teachers; school and district leaders

What factors are contributing to the problem?
The group pointed to the district's discipline policy, which outlined specific behaviors that warranted a suspension without much room for teacher discretion. Where teachers did have discretion, they did not always apply consequences consistently. Teachers in the group said that administrators had not been consistent with their own discipline decisions and that every teacher seemed to have developed their own approaches to discipline. Teachers also reported feeling overwhelmed by large class sizes, feeling as if students did not respect them and feeling as if they did not have the time to get to know their students. The group observed that most of the student body identified as people of color, while the majority of the faculty identified as White, leading to communication, trust and bias issues.

Students of all races in the group attributed some of the inconsistent application of consequences to racism and bias and stated that teachers tended to single out students of color, particularly Black students, who then ended up with reputations as "bad kids." Students said that they found many of the school's rules arbitrary and that the rules were used to treat them like little kids. Students also said that they were bored in some of their classes and that the school did not offer them enough opportunities to get involved in extracurricular activities.

Parents in the group conveyed that they felt frustrated: since they usually did not hear from teachers before a suspension was issued, they could not work alongside the teacher to help their children or reinforce expectations. They also reported not knowing what to believe because they heard different sides of the same story from their children, from teachers and from administrators.

What is happening as a result of the problem?
Many students of color, particularly Black students, reported that they did not trust teachers to treat them fairly. They believed that, no matter what they did, some teachers would not like them and would treat them differently. Teachers shared that they were becoming increasingly overwhelmed and that they felt as if what they were doing was not working, but that they do not know what else to do. They felt reluctant to call parents or to talk to administrators because they did not think that those conversations would change anything. Class time was being disrupted. Some teachers and students said that they dreaded certain classes because of discipline issues. The school's reputation in the community had suffered.

Setting the Boundaries of a Systems Problem

While everything is connected, not everything is relevant to each systems problem. Setting clearly defined boundaries around the problem will make the problem-solving process more meaningful. Defining the problem is the first step in setting boundaries around what parts of the system will be part of the exploration. Two other important kinds of boundaries appear below.

» **What is the timeframe of the systems problem?** Historical data and patterns provide useful information about a problem's evolution over time. Any problem in education can likely be traced back years or even decades. However, selecting a discrete starting point and understanding how the behavior has changed during that time period can free stakeholders to focus only on what is most relevant and useful to understand.

» **Who has influence and authority over the problem?** Though the prospect of solving an entire system's problems may be appealing, the complexity of the world inevitably limits any individual's or group's range of action. Assessing who has authority over different parts of the problem and what level of the system is most primed for change can help stakeholders manage their expectations and identify a realistic focus for their efforts.

No systems change effort can take on an entire system. Setting boundaries sharpens the focus on the specific problem under consideration and on the factors that are most important to solving it.

EXAMPLE

To determine the time boundary, the group discussed the history of the problem of racial disparities in suspensions in their school and how it had changed over time.

While overall suspensions had been declining for a few years, the decline had plateaued during the last two years. Similar racial disparities remained throughout. The group noted that the dynamics among White teachers and students of color, particularly Black students, seemed to cycle in and out of positive and challenging periods. The group decided to use information from the last two years to deepen its understanding of the problem. That timeframe tracked with a meaningful change in the problem – the plateau of overall suspension rates – and allowed the team to speak directly with people who had experienced the problem since that change had occurred.

To determine the sphere-of-influence boundary, participants discussed who had control and authority over the systems problem.

They observed that, when an incident occurred, teachers referred students to the school administrators, who then decided whether the incident warranted a suspension. The group agreed that teachers and administrators both had high levels of control. Students agreed that, while they had control of their behavior, inconsistent consequences made it more difficult for them to know what would warrant a suspension and what would not. For the purposes of this systems exploration, the group decided to look at the problem at the classroom level. Though everyone agreed that the issue was schoolwide, teachers, students and parents felt most comfortable discussing what they had experienced firsthand. School and district leaders offered to provide their views about additional factors that they saw across the school or district.

Wrap Up

In systems as complex as education, even identifying problems can be a challenge. Problems are often hidden under layers of symptoms that masquerade as the problem itself. Furthermore, systems problems are subject to perspective: we assume that others see problems and their causes in the same way we do, and we are frequently surprised when we learn that they do not. Nonetheless, we must engage in deliberate and collaborative effort to identify what needs to change.

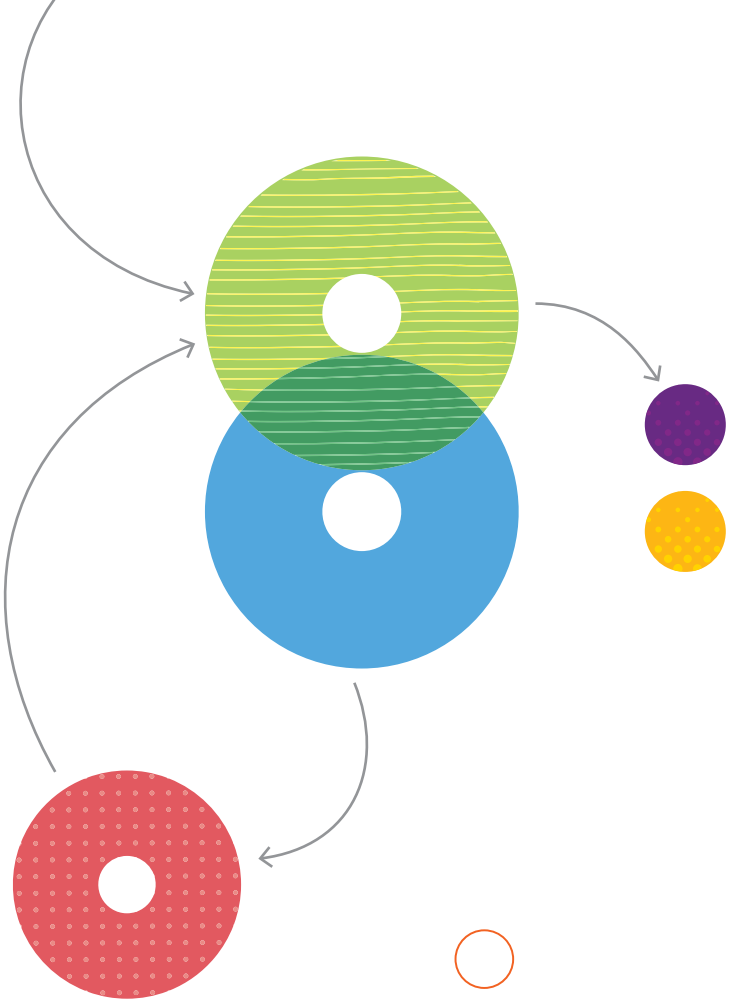
Framing the focus of a systems problem involves:

» Understanding the characteristics of a systems problem

» Identifying a shared systems problem and who and what is involved

» Setting boundaries of time and scope to focus the problem-solving process and organizational learning

When we do not experience our desired results, we often assume that the problem is clear and jump to take immediate action. However, changing a system – or even solving one problem within it – is a long process that involves many small steps. One of those small steps is developing a clear understanding of underlying problems that are affecting our ability to enact the system we hope to see.



> *Everything is connected and interdependent, but when the main thing people take away is that things are complex, that's disempowering. When the tools can start to simplify and manage the complexity, that's when they're useful.*
>
> **Allie Simpson, program coordinator – K-12 education**
> **Social System Design Lab**

PRACTICE

In this section, you will apply the concepts from "Lesson 1: Framing the Focus of a Systems Problem" to your own context and experiences. Refer to the concepts and example from that lesson for guidance.

Complete the practice activities in this guidebook as collaboratively as possible to ensure that you are analyzing your systems problem from multiple perspectives. You may discover through the process that you need to involve and engage more people – whether students, parents or other community members – in order to develop a more complete picture of the system and of the problem at hand.

Defining a shared systems problem is not a linear process or a one-time conversation. You will typically need to revise the framing of the problem and its boundaries several times as you deepen your understanding of your system and the problem you have defined. Conversations about defining shared systems problems are often engaging and sometimes contentious. As the process continues, you will surface more insights, engage in more learning and identify more questions. These insights, learnings and questions are all critical inputs to the process.

Reflecting on the Characteristics of a Systems Problem

With your group, discuss a problem that your system is experiencing. You can begin with a broad problem that you will refine over time. Use the questions below to understand whether the problem that you have identified is related to the structure of the system. You do not need to answer the questions in detail; simply use them to check whether you are on the right track in identifying a systems problem.

a. Could any causes of the problem also be considered effects? Could any effects be considered causes?

b. Has the problem evolved over time?

c. Does the problem seem to persist, even in the face of efforts to solve it?

d. Have past solutions led to unintended consequences, or do you face gridlock in implementing a solution because stakeholders cannot agree on the best approach?

If the answer to any of these questions is "no," continue the discussion to identify a different or refined problem that has the characteristics of a systems problem.

Identifying a Shared Systems Problem

With your group, continue to refine your understanding of the systems problem and stakeholders' perspectives on it by responding to the questions below. Sometimes, what seems like one systems problem turns out to be several problems combined. You might need to revisit these questions several times to identify the core problem that your group would like to address. In this section, be as specific and detailed as you can, surfacing differences in viewpoint and experience.

a. What specific system behavior do people in the system agree is a problem?

b. Who has a stake in the problem? Who is contributing to it, and who is affected?

c. What factors are contributing to the problem?

d. What is happening as the result of the problem?

Setting the Boundaries of a Systems Problem

Use the questions below to further refine your understanding and to focus your exploration of the shared systems problem.

1. Establish the time boundary.
   a. When did the current problem begin?
   b. Describe how the problem behavior has evolved over time (e.g., slowly increasing, cycling up and down), referring to quantitative data when possible.
   c. What time boundary would support a meaningful exploration of the problem?

2. Establish the sphere-of-influence boundary.
   a. Who has the most control over the problem?
   b. Where does the problem occur (e.g., neighborhood, classroom, school)?
   c. Over what aspects of the problem does the group have most authority?
   d. What sphere-of-influence boundary would allow the group to address the problem in a meaningful way?

3. Revise your responses to the questions from "Identifying a Shared Systems Problem" to reflect the boundaries that you set.

> *"As people become systems thinkers, they realize that their view of the system is often limited, isolated and incomplete. I can think of a school involved with improvement planning where we suggested, 'Let's involve the students and learn from their perspectives to help us see the system from their vantage point and ask them what's been causing the current underperformance.' Initially, there was a real hesitancy to do that. It took some time before leaders realized the importance of student voice, perspectives and insights. When school improvement is primarily adult-driven, that system view is incomplete, and, as a result, improvement plans seldom move the performance needle in significant ways. In time, students started getting involved and were given the tools and the habits of systems thinking so that they could share a common language with the adults in talking about their school. The students' perspectives generated more informed strategies that came from new mindsets about what was going on.*
>
> **Tracy Benson, president**
> **Waters Center for Systems Thinking**

2 VISUALIZING THE STRUCTURE OF A SYSTEMS PROBLEM

One of the most powerful aspects of systems thinking is its ability to help make thinking visible so that it can be examined, discussed and shifted. Each individual and stakeholder carries mental models about how their systems are structured and how the problems within them operate. Often without realizing it, everyone uses their mental models to guide their actions, to inform their conversations and to solve problems. When two or more conflicting mental models are hidden and implicit, they can form a barrier to shared understanding and collaborative action. When they are made visible, the conflicts between them can be reconciled, and they can serve as the basis for discussion and collaborative problem solving.

Causal loop diagrams are a core tool of systems thinking. They help stakeholders visualize the structure of a system, surface differences among their mental models and clarify individual and collective understanding of the system and the specific problem being addressed. They do so by identifying the factors that contribute to a problem and the relationships among them.

More specifically, causal loop diagrams connect variables, identify causal links between them and show the feedback that exists within a system. Variables are any components of a system's structure that can change over time. Causal links indicate when variables have a cause-and-effect relationship; they are represented by arrows. Feedback loops illustrate when variables are all causing one another to change while also being changed by one another; they are represented by closed circles of causal links. While no diagram can capture the complexity and nuance of real life, creating a causal loop diagram can often surface more insights than simply discussing a system. Figure 1 (right) shows a simple diagram with variables, causal links and a feedback loop labeled.

The relationships among variables create the structure of any system. By identifying the variables, labeling the links between them and finding feedback loops, stakeholders can have more specific and fruitful conversations about their system and how its behavior differs from the vision that they hope to realize. Depicting what is happening in this way helps set the stage for discussion about how to address deep problems and also helps surface opportunities for transformation.

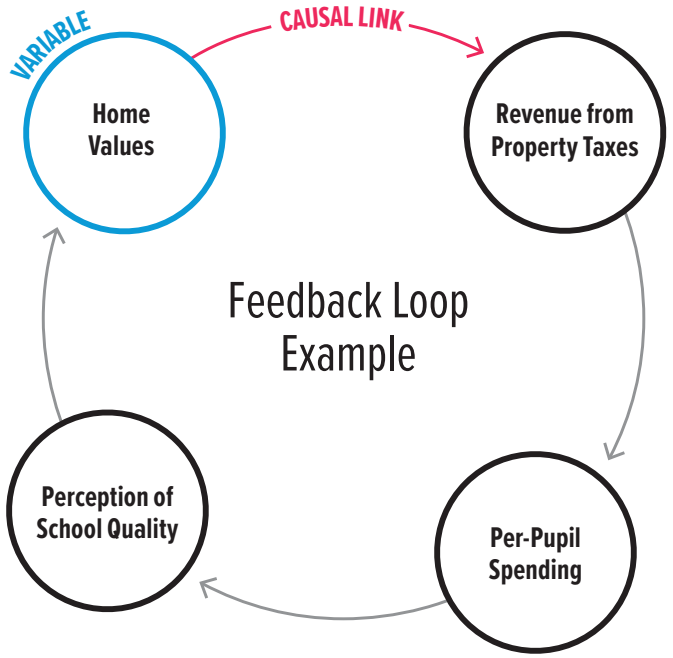


Figure 1. Labeled causal loop diagram.

Identifying the Variables

Creating a causal loop diagram begins with identifying what variables are contributing to a systems problem. Examples of variables include "ratio of students to teachers," "costs," "quality of collaboration," "amount of trust" and "average GPA." Though not all these variables are easy to measure, they all represent quantities that can increase or decrease over time.

As these examples illustrate, variables can be people, objects, resources, outcomes or aspects of people's experiences. If the causal loop diagram is a visual explanation of a problem, then the variables are the nouns in the explanation.

Only components that can increase or decrease over time can be included as variables. However, a component can become a variable with the addition of a phrase such as "amount of," "level of," "degree of," "quality of" or "number of" added to the beginning of its label. Those phrases are not interchangeable, as they modify the item's definition. For example, "money," "hiring new teachers" and "inclusive" are not variables. They can become variables with some revision: "amount of money," "number of new teachers" and "degree of inclusion" are variables.

When we recognize the variables contributing to a systems problem, we begin to make the problem tangible. We take the first steps toward deepening our understanding of the underlying system and taking focused action.

EXAMPLE

To find the variables related to the systems problem, the group revisited their explanations of what was happening and who was involved and noted the nouns. Participants revised some elements that did not qualify as variables; for example, they changed "out-of-school suspensions" to "number of out-of-school suspensions." Other critical variables upon which they agreed included "number of incidents of student misbehavior," "class size," "level of student engagement," "percentage of teachers of color on faculty," "level of trust between students and teachers" and "level of teachers' willingness to acknowledge bias." Their final list included approximately 30 variables. A few members of the group argued that some variables on the final list were not as important as others. After discussing those concerns, everyone agreed to keep the initial list, knowing that they would add, remove and revise variables throughout the process.

> *There is something powerful about putting your mental models on paper and being able to discuss them with other people, to see their mental models and to pressure test them. It's not about who's right and who's wrong but about what's actually going on in the system. If I see it one way and you see it another way, how have our experiences and our mental models shaped what we think the system is? What can we do to address the system, even though we see it differently? I think that's what makes it so powerful and engaging.*
>
> **Trevor Hicks, program associate, SkipNV, and Harris-Stowe University senior studying secondary education**

Labeling the Links

Once the variables are in place, they can be linked. In a causal loop diagram, causal links between variables are depicted using arrows. Their labels describe whether the variables increase or decrease in the same direction or in opposite directions.

In a causal loop diagram, the only relevant relationship is when one variable causes another to increase or decrease over time. Including only causal relationships focuses attention toward the variables and the links in the system that are causing the problem and away from those that are simply related to it.

Causal loop diagrams are built one link at a time. Two variables can be linked if one causes the other to increase or decrease over time. The effects of one variable on another do not need to be immediate; indeed, they often are not. Figure 2 (below) illustrates how two variables can be linked.

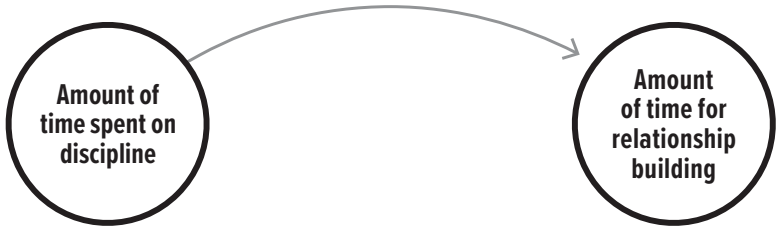


Figure 2. Linking two variables.

Once the directionality from one variable to another has been established, the link is labeled according to how variable A influences variable B. Links are labeled "**S**" for "**same**" if the variables increase or decrease in the same direction and "**O**" for "**opposite**" if they increase or decrease in opposite directions. Table 1 shows how links between variables are labeled based on the variables' relationship.

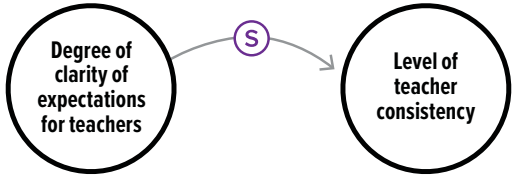
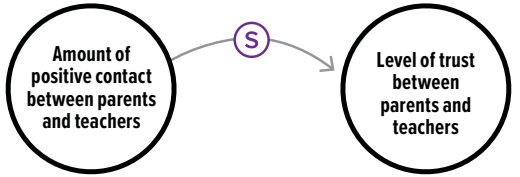
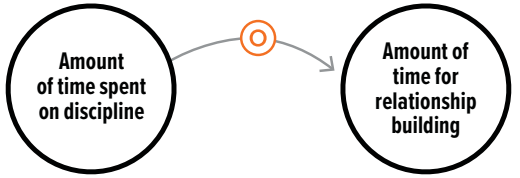
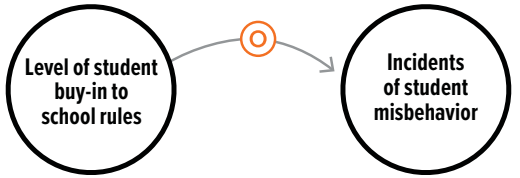
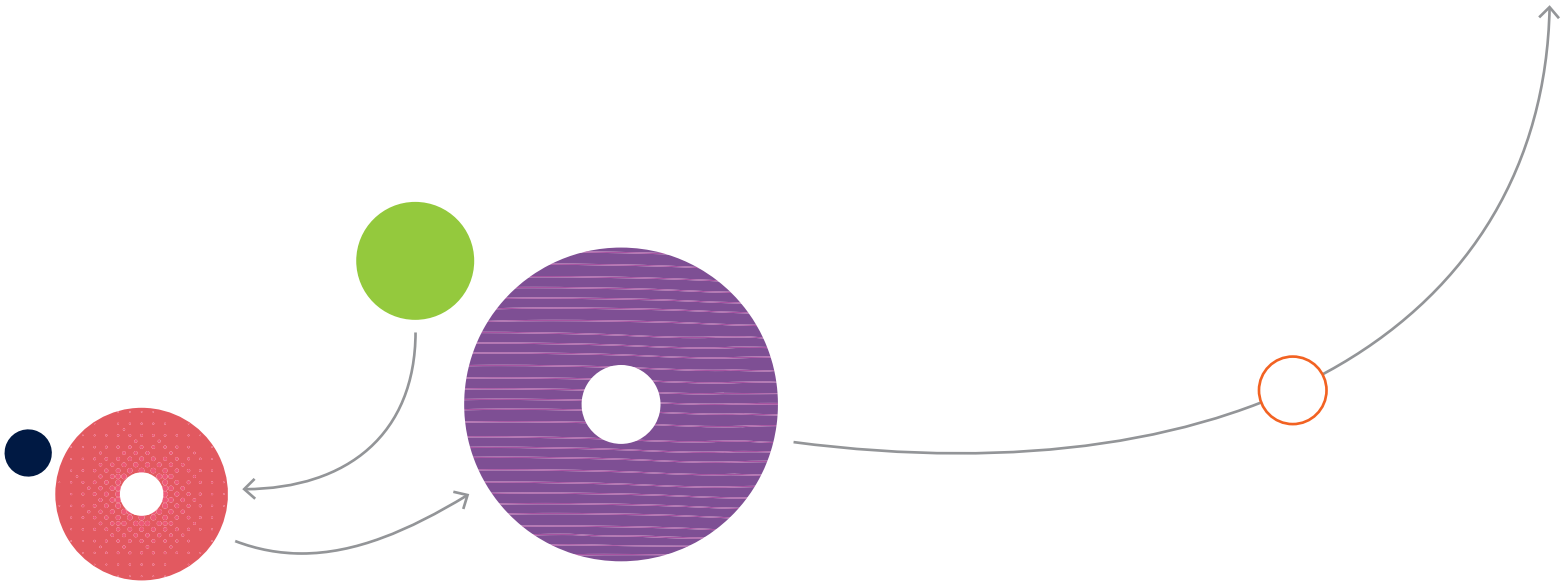
An ***increase*** in the clarity of expectations for teachers causes an ***increase*** in the level of teacher consistency	
A ***decrease*** in the amount of positive contact between parents and teachers causes a ***decrease*** in the level of trust between parents and teachers	
An ***increase*** in the amount of time spent on discipline causes a ***decrease*** in the amount of time for relationship building	
A ***decrease*** in the level of student buy-in to school rules causes an ***increase*** in the number of incidents of student misbehavior	

Table 1. Labeling links.

Once two variables have been linked in one direction, the process can be repeated in reverse to identify how variable B influences variable A. Often, the causal relationship does not exist in reverse, or a causal relationship exists only indirectly, with additional variables included in the path.

If we hope to understand our systems and the problems that we intend to solve, we must work to articulate how the relevant variables connect with and influence one another. Furthermore, because casual loop diagrams reflect our mental models, our understanding of how variables interact is born from our perspectives and experiences. When we reflect on the causes and effects that exist within our systems and on how they contribute to systems problems, we expose our thinking and assumptions to the light of day and make way for shared understanding and fresh thinking.

> *Cars and motorcycles are very complex electro-mechanical systems. Hundreds of engineers work on designing and producing them. Now, how in the world can hundreds of engineers work together and end up producing such complex vehicles? They have blueprints, and they have a common language. They have these drawings that they bring, meeting to meeting. When they have issues, they point to where in the car or in the motorcycle the issue lies. Social systems are infinitely more complex than any automobile or motorcycle, and yet we do not even use such rudimentary tools.*
>
> **Daniel H. Kim, founding trustee**
> **Society for Organizational Learning**



EXAMPLE: Labeling the Links

The group split into subgroups and began to link the variables from their list. At first the diagrams all looked different from one another, even though they included many of the same variables. The group then drew upon those drafts to create a whole-group diagram, discussing the variables and the links and creating the full picture one link at a time. Participants discussed the nature of the relationships among the variables, reworded them where necessary, added new variables and eliminated others that sat outside the scope of the discussion. As the causal loop diagram began to take shape, the group acknowledged that, while many variables did not seem to fit in the current diagram, they were no less important than those that did fit.

As the group created and revised the diagram, not all of the links among variables were obvious. For example, while everyone agreed that "level of student buy-in to school rules" linked directly to the "number of incidents of student misbehavior," some argued that the relationship did not exist in reverse. They found a path that connected those variables, and added it to the diagram. Figure 3 shows the completed causal loop diagram that reflected the participants' collective understanding of how one part of the system was operating.

As shown at right, the group also created a legend for the variables to ensure that everyone shared a common understanding of what the variables meant and could explain their meaning to others.

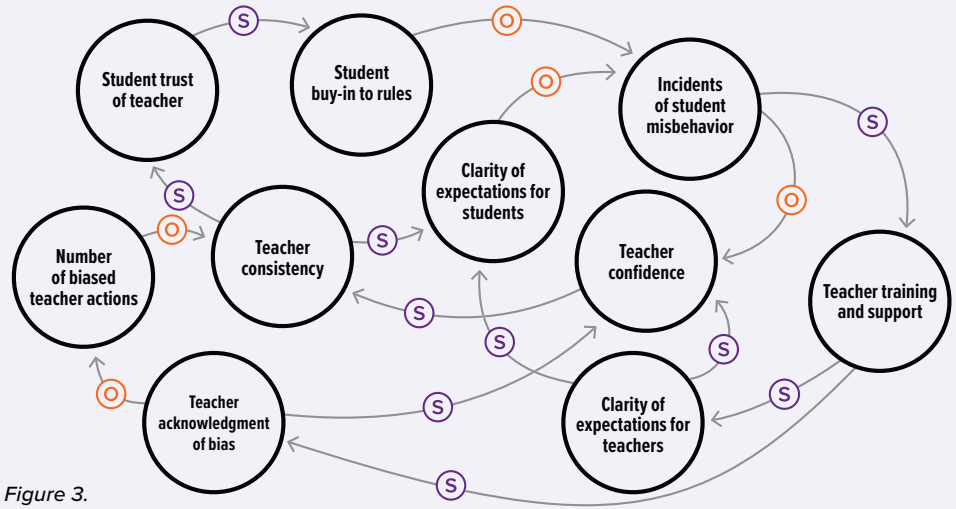


Figure 3.
Example causal loop diagram with causal links labeled.

Incidents of student misbehavior: The number of times student behavior requires teacher intervention.

Teacher training and support: The amount of formal and informal training and support that teachers receive from administration and other professional development opportunities.

Clarity of expectations for teachers: Teachers' level of understanding about what is expected of them from administrators and parents regarding discipline.

Clarity of expectations for students: Students' level of understanding about what is expected of them from teachers regarding behavior.

Teacher confidence: The amount of confidence that teachers have in their ability to handle discipline issues.

Teacher consistency: The level of consistency exhibited by a teacher in handling situations when students do not meet expectations.

Teacher acknowledgment of bias: The extent to which teachers regularly reflect and accept that racial bias is part of society, the education system and their classrooms and influences their actions.

Number of biased teacher actions: The number of times a teacher takes action that reflects racial bias, either consciously or unconsciously.

Student trust of teacher: The level of trust students that have with their teacher.

Student buy-in to rules: The extent to which students believe that the rules they have to follow are legitimate.

Looking for Feedback Loops

Feedback loops occur when two or more variables influence one another. Feedback loops are sometimes called causal loops. In a causal loop diagram, links become loops when the arrows form a closed circle. Figure 4 (below) illustrates a feedback loop extracted from the causal loop diagram shown in Figure 3 (previous).

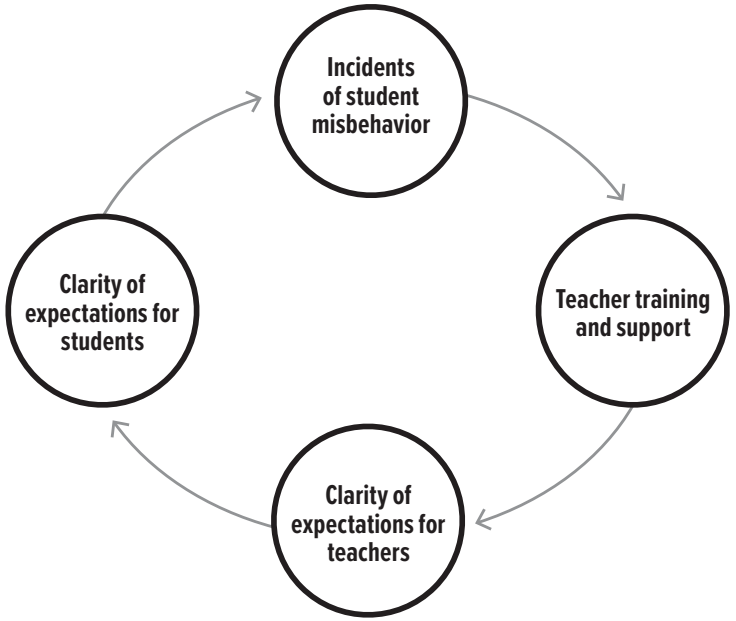


Figure 4. Feedback loop.

In any systems problem, one or more feedback loops is at play, allowing the system behavior to persist even if no individual or group is actively working to perpetuate it. Feedback loops can create chains of behaviors that reinforce themselves. They are also sources of stability, inertia and resistance to change. Identifying the feedback loops and understanding how they are operating in a specific system are critical to informing sustainable systems change.

When the relationships among variables in a feedback loop amplify one another's effects, the feedback loop is reinforcing. In a causal loop diagram, it is labeled with an "**R**" for "**reinforcing loop**." In the example in Figure 5 (below), as incidents of misbehavior increase, teacher confidence in making discipline decisions decreases, which causes teachers' level of consistency to decrease, which in turn causes students' clarity of expectations to decrease, which causes a further increase in the incidents of misbehavior. The feedback among those variables is leading to increases in incidents of misbehavior, which means that it is amplifying the original outcome. If incidents of misbehavior were decreasing, the relationships among these variables would cause the incidents of misbehavior to decrease further. In a reinforcing loop, any variable could serve as the starting point. It could be changing in any direction, and the amplifying effects would remain.

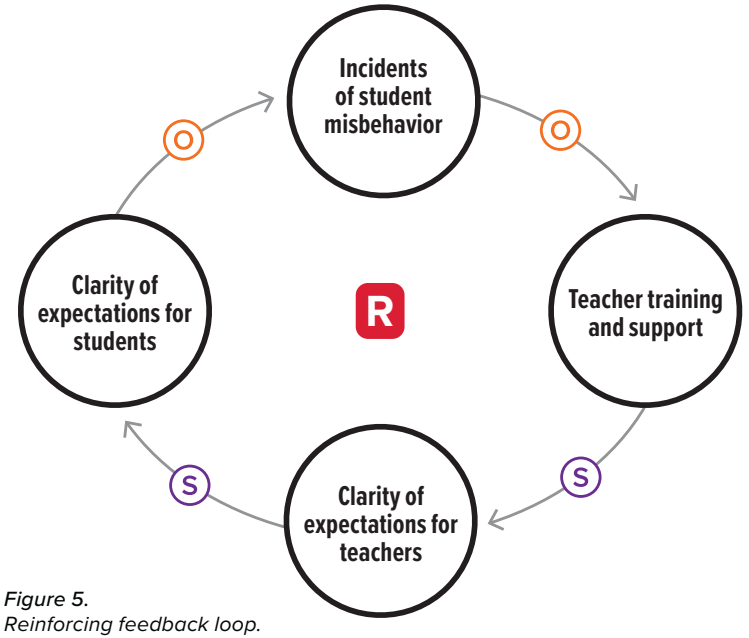


Figure 5.
Reinforcing feedback loop.

If, on the contrary, the relationships among variables in a feedback loop balance out one another's effects, the feedback loop is balancing. In the causal loop diagram, it is labeled with a "**B**" for "**balancing loop**." In the example shown in Figure 6 (below), as incidents of misbehavior increase, the amount of training and support that teachers receive increases, which causes teachers to have more clarity about what is expected of them. Teachers' increased clarity leads students to have more clarity about what is expected of them, which in turn leads incidents of misbehavior to decrease.

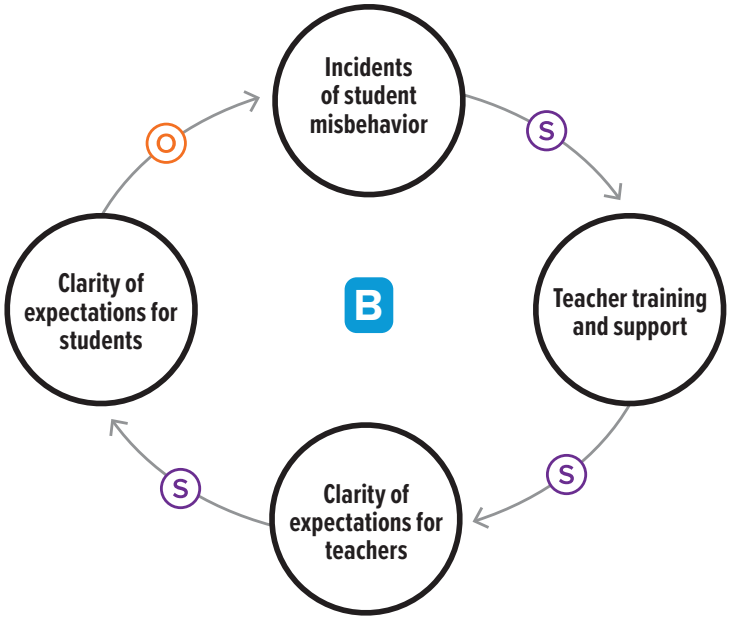


Figure 6. Balancing feedback loop.

Feedback loops are often connected to one another, with variables playing a part in more than one feedback loop. A feedback loop may surround variables not involved in the loop, and more than one feedback loop can branch off of a single variable. Feedback loops are not always obvious, particularly in more complex causal loop diagrams. Figure 7 (below) illustrates how one feedback loop can be contained within another.

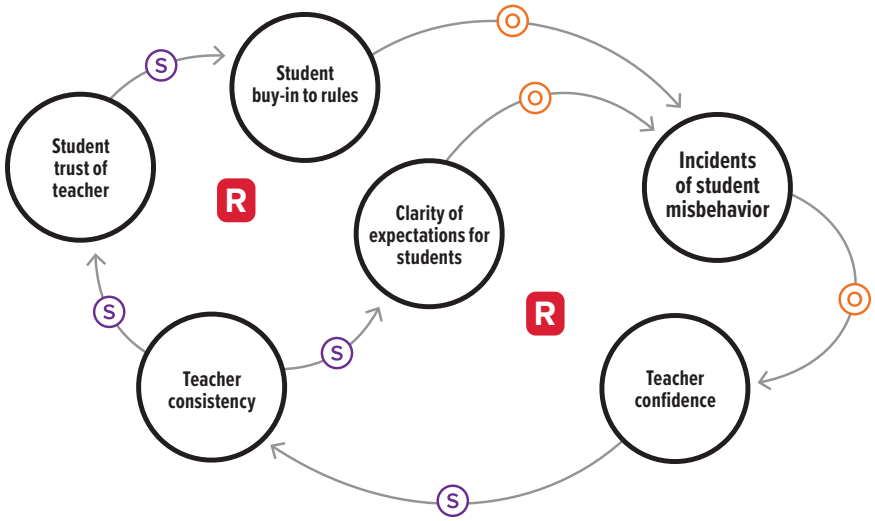


Figure 7. Connected feedback loops.

Once the feedback loops have been labeled, the causal loop diagram can be used as the basis for analysis. Stakeholders can see how the variables reinforce or balance one another. Connections among disparate variables become clear, and discussions about how to structure the system differently can become more concrete.

EXAMPLE: Looking for Feedback Loops

The group built upon its causal loop diagram, finding closed loops, discussing whether those loops were reinforcing or balancing and labeling them accordingly. This process resulted in the causal loop diagram shown in Figure 8 (below).

The process of creating and analyzing the causal loop diagram led the group to a few insights and questions about the problem of racial disparities in suspensions and the system overall, as detailed below.

- Teachers had received implicit bias training, along with training on classroom management, but those trainings had been sporadic and disconnected and had often occurred after a major incident or an increase in discipline issues. The group saw the value in these trainings but did not think that responding to a crisis was the best impetus for them because the effects of the training wore off over time, until the next crisis occurred.
- Teachers who had found implicit bias and anti-racism training useful believed that it had made them more confident in knowing how to handle situations fairly and in knowing when to seek help or to change their approaches. However, they pointed out that their confidence had developed over time, which led to a delay in the positive outcome of that training.
- The group recognized that students' understanding of expectations and buy-in to the rules were equally important for reducing incidents of misbehavior. Students said that their respect for, and relationship with, a teacher determined how much they respected the rules. The group wondered how more authentic student buy-in to, or sense of ownership of, the rules, separate from their relationships with individual teachers, might affect behavior and discipline across the school.

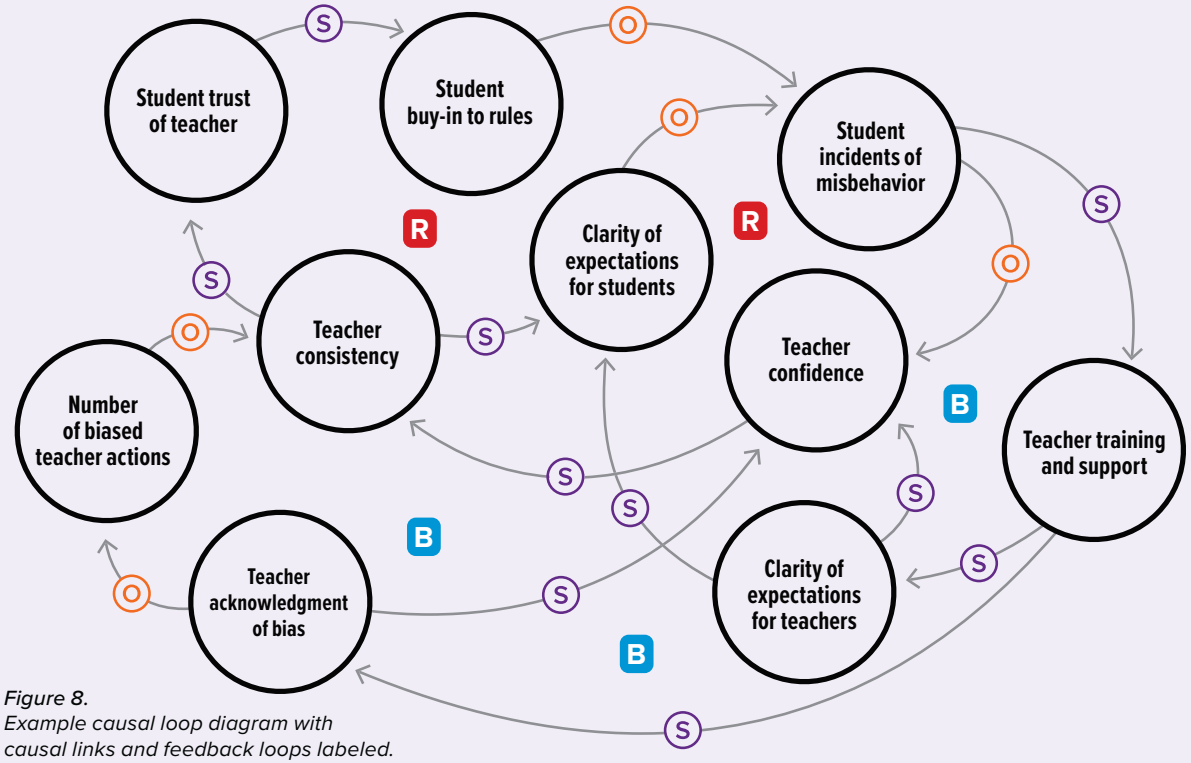


Figure 8.
Example causal loop diagram with causal links and feedback loops labeled.

Wrap Up

A causal loop diagram tells a visual story of what forces are at play beneath the surface of a system and the ways in which its structure – or the way the system is organized – is leading to its behavior. When we see the variables, links and feedback loops mapped out and tinker with how the system might operate differently if it had a different structure, we begin to see ways in which different actions could lead to different outcomes.

Causal loop diagrams are powerful tools for conversation and collaboration. They can also be frustrating to create, intimidating to discuss and painful to face, particularly when the process of creating them challenges our deeply held beliefs or reveals our own uncertainties. But questions such as, "Does variable A actually influence variable B? If variable A increases, will variable B also increase? Do we want that? Is that what's actually happening?" are illuminating. Through them, we can examine our assumptions and reflect on a systems problem, its variables and the links among them in new ways. Exploring and sharing our uncertainty with others is part of the value of the process. These check points serve as reminders that the causal loop diagram reflects and helps expose our mental models.

The purpose of creating casual loop diagrams is not to discover the true structure of the system or the best solution to the problem. Rather, causal loop diagrams help us have productive conversations that can lead to focused and sustainable change efforts.

Visualizing the structure of a systems problem involves:

» Identifying the variables that relate to a systems problem and which can increase and decrease over time

» Labeling the links among the variables according to whether they increase and decrease in the same direction or in opposite directions

» Identifying reinforcing and balancing feedback loops and reflecting on the structure of the system

Creating causal loop diagrams can lead to informed choices and clear shared understanding of what stands between us and our aspirational visions.

Systems Archetypes

Some systems problems are ubiquitous. For example, shared resources are exploited. Quick fixes compound the problem. Current winners stay winners. Though every system is unique, systems often fall into similar structural patterns. These patterns can be traps that prevent meaningful change, even in the face of dedicated action. In systems thinking, these patterns of behavior are known as ***systems archetypes****. Systems archetypes can be visualized as generic causal loop diagrams whose basic patterns may be observed in many specific systems. The field of systems thinking recognizes about a dozen different systems archetypes.*[6]

With the help of systems archetypes, stakeholders can recognize when common patterns of system behavior are at play in their systems. That recognition can illuminate the crux of a challenge or explain why obvious, well-intentioned or popular solutions might not be working. It can also provide reassurance in the knowledge that one's system is not uniquely challenged. Being familiar with the common ways in which systems run into trouble can help expedite the recognition of a potential problem and can offer a starting point for changing the underlying structures that are holding a system back or producing undesirable results.

Not every system structure fits an archetype, nor can archetypes explain all problematic system behavior. However, exploring systems archetypes can provide a reference point for examining challenges and a spark for inciting conversation and reflection among stakeholders.

PRACTICE

In this section, you will apply the concepts from "**Lesson 2: Visualizing the Structure of a Systems Problem**" to your own context and experiences. Refer to the concepts and example from that lesson for guidance.

Causal loop diagrams do not begin as neat and tidy drawings. As with framing the focus of a systems problem, creating a causal loop diagram is often an iterative process. Give your group the time, space and materials to work through many iterations of the diagram and expect to work through several rough drafts before settling on one that you think represents your systems problem well.

Identifying the Variables

1. With your group, review your explanations of your shared systems problem, the stakeholders involved and the causes and effects.
2. Create a list of the important nouns from your responses.
3. Create a table modeled after Table 2 below.
4. Assess which nouns from your list are variables and which ones need to be revised to turn them into quantities that can vary. Use the examples in Table 2 for guidance.
5. Refine your list of variables so that they reflect the group's understanding of the most important variables in your shared systems problem. Doing so may involve adding new variables to the list, removing others and agreeing on the specific name of each variable so that it reflects the group's shared understanding.

Noun	**Is this noun a variable?** *Is it a quantity that can increase or decrease over time?*	**If this noun is not a variable, can it be turned into one?** *Try adding amount of, level of, degree of, quality of or number of.*
Level of trust between students and teachers	Yes	No change
District discipline policy	No	**Try:** Level of teacher discretion in district discipline policy
Training	No	**Try:** Amount of training

Table 2. Example of identifying the variables

Labeling the Links

1. Gather materials to create a causal loop diagram, such as a piece of flip chart paper and markers or access to a digital causal loop diagramming tool.[7]
2. Select a variable from your table that seems important to the systems problem that you are exploring.
3. Write the name of the variable on the diagram. Label it "A."
4. Discuss: If variable A increases or decreases, what is another variable from your table that would also change?
5. Based on that discussion, select a variable from your table that could be linked to variable "A."
6. Write the name of the variable on the diagram. Label it "B."
7. Draw an arrow pointing from A to B.
8. Use Table 3 (below) to determine the nature of the link between variables A and B.
9. Label the link between variables A and B.

IF...	THEN...
An **increase** in Variable A causes an **increase** in Variable B	Label the link with "**S**" for "same."
A **decrease** in Variable A causes a **decrease** in Variable B	Label the link with "**S**" for "same."
An **increase** in Variable A causes a **decrease** in Variable B	Label the link with "**O**" for "opposite."
A **decrease** in Variable A causes an **increase** in Variable B	Label the link with "**O**" for "opposite."
Variable A seems to cause some change in Variable B, but the nature of the influence is unclear	**Ask:** *Should one or more of the variable titles be reframed or revised to capture the relationship more accurately?* **Ask:** *Is this a direct relationship? Do other variable need to be added between these two to capture the relationship accurately?* **Ask:** *Can increases or decreases in Variable A cause increases or decreases in Variable B, or are they simply related?*

Table 3. Labeling the links.

10. Use Table 4 (below) to determine whether variable B is also causing increases or decreases in variable A.
11. Repeat the process with the rest of the variables on your list, gradually adding to your causal loop diagram. Some variables from your list may not end up in the diagram, or you may need to add others that you did not originally identify.

IF...	THEN...
An **increase** in Variable B causes an **increase** in Variable A	Label the link with "**S**" for "same."
A **decrease** in Variable B causes a **decrease** in Variable A	Label the link with "**S**" for "same."
An **increase** in Variable B causes a **decrease** in Variable A	Label the link with "**O**" for "opposite."
A **decrease** in Variable B causes an **increase** in Variable A	Label the link with "**O**" for "opposite."
Variable B does not cause Variable A to **increase** or **decrease**	Do not add a link
Variable B seems to cause some change in Variable A, but the nature of the influence is unclear	**Ask:** *Should one or more of the variable titles be reframed or revised to capture the relationship more accurately?* **Ask:** *Is this a direct relationship? Do other variables need to be added between these two to capture the relationship accurately?* **Ask:** *Can increases or decreases in Variable B cause increases or decreases in Variable A, or are they simply related?*

Table 4. Labeling the links in reverse.

Looking for Feedback Loops

1. After you have mapped all the links among variables, look for feedback loops, or closed circles of variables.
2. If your diagram includes a feedback loop with two variables, use Table 5 (below) to determine whether the loop is reinforcing or balancing.

IF...	THEN...
Variable A and Variable B **increase** together	Label the loop with "**R**" for "reinforcing."
Variable A and Variable B **decrease** together	Label the loop with "**R**" for "reinforcing."
Variable A **decreases** when Variable B **increases**	Label the link with "**B**" for "balancing."
Variable A **increases** when Variable B **decreases**	Label the link with "**B**" for "balancing."

Table 5. Labeling feedback loops.

3. If your diagram includes a feedback loop with more than two variables, use one or both of the methods on the next two pages.
4. Label the remaining loops in your diagram.
5. Reflect on your diagram: What insights does it spark? What new questions do you hold about your system or the shared systems problem that you are exploring?

Thumbs Up, Thumbs Down

- Select one variable from the loop.
- Point your thumb up and ask: "If this variable increases, what happens to the next variable in the loop?"
- If the next variable also increases, keep your thumb up and repeat the question for the next variable.
- If it decreases, point your thumb down and ask: "If this variable decreases, what happens to the next variable in the loop?"
- Repeat for the rest of the variables in the loop, switching the direction of your thumb and the wording of the question according to the relationships between the variables.
- At the end of the circle, is the original variable increasing or decreasing (i.e., is your thumb still up, or is it down)?
- If the original variable is increasing, meaning that the feedback loop amplifies its behavior, label the loop with "R" for "reinforcing."
- If the original variable is decreasing, meaning that the loop balances out its original direction, label the loop with "B" for "balancing."

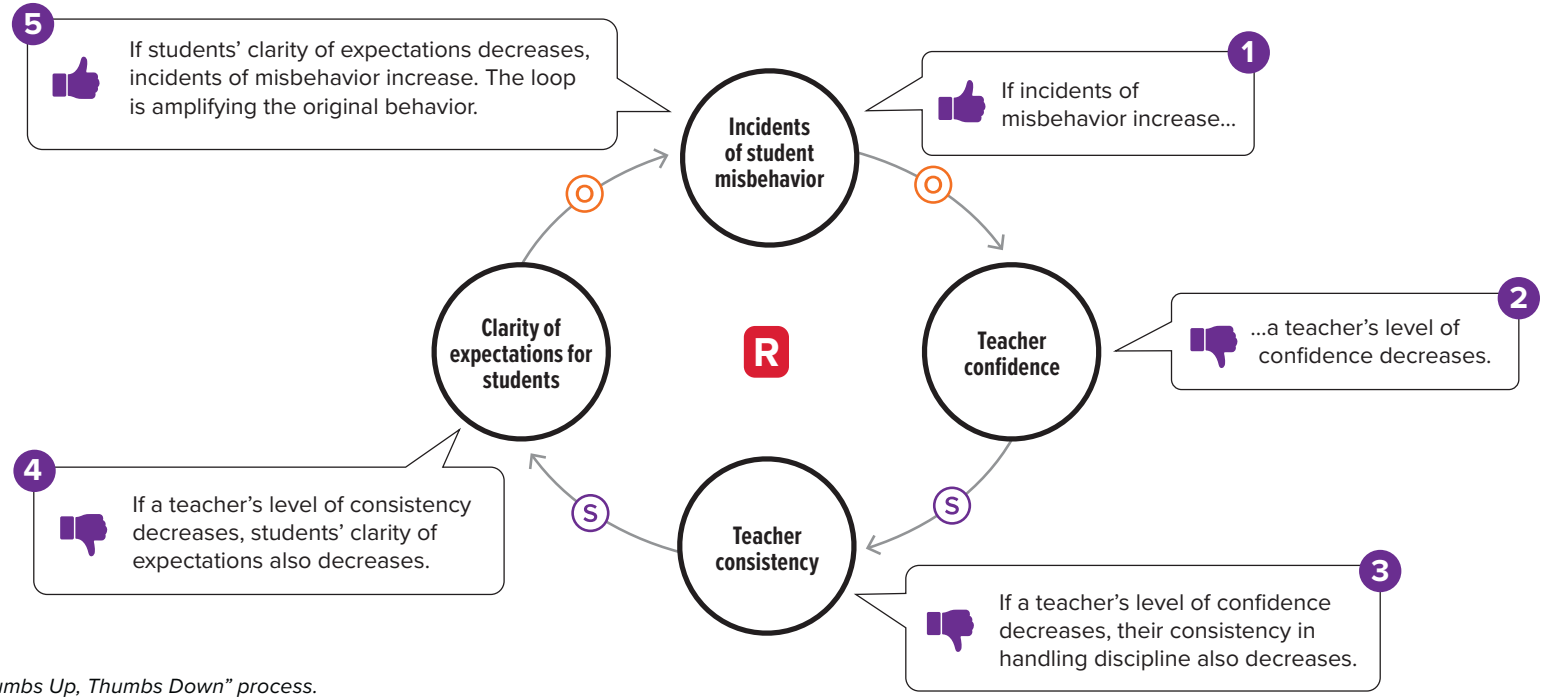


Figure 9a. "Thumbs Up, Thumbs Down" process.

Count the O's

- Count the number of "O" labels in the feedback loop.
- An even number of "O" labels, or none at all, results in a reinforcing loop because the balancing links cancel each other out, erasing the effects of any stabilizing force.
- An odd number of "O" labels results in a balancing loop because one or more of the links is stabilizing the increase or decrease in other variables in the loop.

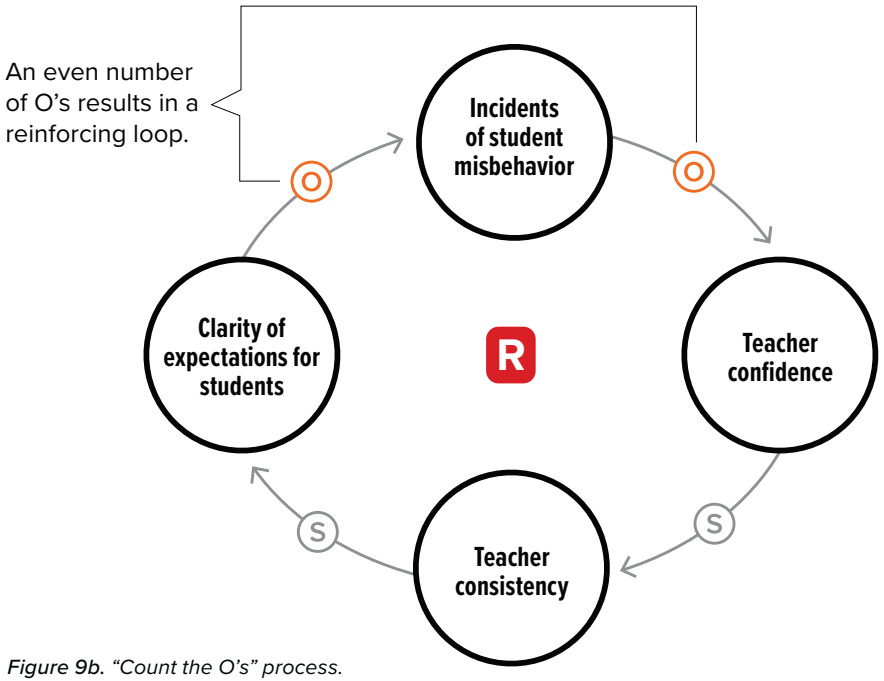


Figure 9b. "Count the O's" process.

> *I think a lot of times people believe that the diagram is the desired outcome. But I really think it's the process. The diagram will always be only a snapshot of the point in time of the people who made it. It will always be in flawed because it's limited by the mental models of the people who made it, and nobody has a complete story of what's happening. There's never a right answer, but the process of engaging people in collaborating and understanding the system is the real desired outcome.*
>
> **Allie Simpson, program coordinator – K-12 education**
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3 LOOKING FOR LEVERAGE TO CREATE CHANGE

Causal loop diagrams help stakeholders visualize a part of a system and consider how its structure might be misaligned with their desired outcomes. However, that process might not clarify what action to take. In fact, any obvious solution should be subject to reflection, questioning and further conversation. Creating change requires that stakeholders identify where they have leverage, or where focused action could change the behavior of the entire system.

The concept of leverage comes from physics. If a group were attempting to move a heavy object, its members would assess what action to take to move the object toward its intended position while expending the least amount of effort. Doing so might require them to use a tool or to lift from a certain place. The group would be looking for a physical leverage point.

In a similar way, stakeholders can use principles of systems thinking to look for leverage points in social systems. Actions that have deep impact and which require a relatively low amount of effort are considered high leverage. Actions that have less impact and which require a great deal of effort are considered low leverage.

The level of effort or resources that any action may require will be specific to each system and can only be determined by the stakeholders in that system. However, systems thinking offers some generalizations about how deep an impact any given action might make.

The types of actions that stakeholders might take to change a system can be roughly categorized into four groups according to their potential depth of impact. This taxonomy is an adaptation of Donella Meadows' description of the different places to intervene in a system:[8]

Level 1: Parameters of the System
Level 2: Interactions among Variables within the System
Level 3: Structures That Determine the Interactions
Level 4: Mental Models That Underlie the System

Categorizing actions based on their potential depth of impact can help stakeholders identify whether their proposed efforts are high- or low-leverage. As always, different stakeholders may hold different views of what level a certain action belongs in, and experts acknowledge that these levels are not absolute. In addition, some higher-level actions may require prerequisite or supportive actions from the same or other levels in order to be fully effective. Nonetheless, thinking through the taxonomy of the depth of impact can help clarify just how powerful a proposed action might be.

> *"All systems are perfectly designed to generate the behaviors that they produce. This premise means that there is no one person or entity to blame when things aren't going well. Instead of trying to figure out who is the cause or who is to blame, look at the way a system is designed and ask, 'How is the system structured, and what is it about the current design that gets us to those disappointing results?' and, 'What role do I and do we play as design leaders of that system? Can we accept the possibility that the current system design is made to produce lackluster results?'*
>
> **Tracy Benson, president**
> **Waters Center for Systems Thinking**

Level 1
Parameters of the System

Actions within this level adjust variables or characteristics of the system without changing any of its underlying structures. Because Level 1 solutions only change components, not the structure of the system, they are unlikely to change the fundamental outcomes of the system.

Table 6 below outlines the types of actions that could fall into Level 1.

Does the action...	...change the amount of a variable...	...without changing any causal links or feedback loops within the system?
	...change an actor...	
	...set a standard...	
	...add or remove a physical structure (e.g., a building)...	
	...buffer effects of the system's behavior...	
	...change general characteristics or parameters...	

Table 6. Level 1 actions.

Level 1 actions are often accessible and may be important to undertake, but they are the lowest leverage and will have the least amount of impact on the overall system.

EXAMPLE

The group developed a list of possible Level 1 actions that might address racial disparities in suspensions.

- Change students' schedules so that students did not interact with certain teachers (change an actor).
- Do more teacher training in the same way that it had been done before (change the amount of a variable).
- Create new rules for students or teachers (set a standard).
- Offer one-time counseling for students who had been suspended (buffer the effects of the system's behavior).

While the team believed that some of the Level 1 actions were worthwhile and even necessary, everyone acknowledged that these actions alone would not address the underlying problems driving disparities in discipline outcomes.

> *It's not that parameters are not important — they can be, especially in the short term and to the individual who's standing directly in the flow. People care deeply about such variables as taxes and the minimum wage and so fight fierce battles over them. But changing these variables rarely changes the behavior of the national economy system. If the system is chronically stagnant, parameter changes rarely kick-start it. If it's wildly variable, they usually don't stabilize it. If it's growing out of control, they don't slow it down.*
>
> **Donella Meadows, *Thinking in Systems***[9]

Level 2
Interactions among Variables within the System

Actions within this level adjust how elements within a system interact, either by shortening a delay between a cause and an effect or by changing the way a feedback loop operates.

Table 7 below outlines the types of actions that could fall into Level 2.

Does the action...	...change how long the effects are felt or known after an initial cause?
	...strengthen a balancing feedback loop?
	...limit the power of a reinforcing feedback loop?
	...change the direction of a reinforcing feedback loop (from growth to decline or vice versa)?

Table 7. Level 2 actions.

Level 2 actions begin to address causal links and feedback loops and therefore begin to address the system's structure. However, because they are often simply slowing or pushing back against certain systems behavior, they are unlikely to lead to sustainable change.

EXAMPLE

The group developed a list of possible Level 2 actions that might address racial disparities in suspensions.

- Respond to major incidents or increases in incidents of misbehavior more quickly (reducing the delay between an incident and a response).
- Find ways to reinforce expectations for students' behavior and teachers' responses more regularly, not only after behavioral incidents occur (strengthening the balancing loop that could reduce incidents of misbehavior)
- Find ways to increase teacher confidence in handling discipline apart from how students are behaving in their classes (limiting the power of the reinforcing loop).

> *A balancing feedback loop is self-correcting; a reinforcing feedback loop is self-reinforcing...reducing the gain around a reinforcing loop – slowing the growth – is usually a more powerful leverage point in systems than strengthening balancing loops, and far more preferable than letting the reinforcing loop run. It's the same as slowing the car when you're driving too fast, rather than calling for more responsive breaks or technical advances in steering.*
>
> **Donella Meadows, *Thinking in Systems*[10]**

Level 3
Structures That Determine the Interactions

Actions within this level adjust the way the system is designed, organized or governed. Because the behavior of a system is a function of its structure, when the structure changes, the interactions of the variables within the system and the overall system behavior also change. Such adjustments may involve changes to laws or rules, the creation of incentives, increased flexibility to make change or increased transparency.

Table 8 below outlines the types of actions that could fall into Level 3.

Does the action...	...add feedback loops or information flows where they did not previously exist?
	...change the rules by which the system operates?
	...enable the system to change or evolve in response to shifting conditions?

Table 8. Level 3 actions.

Level 3 actions begin to introduce new structures to the system, opening opportunities for a system to produce entirely new behavior.

EXAMPLE

The group developed a list of possible Level 3 actions that might address racial disparities in suspensions.

- Add ongoing learning opportunities for teachers and new triggers for teacher training, such as requests from teachers, students or parents (adding new information flows and possibly new feedback loops)
- Involve students, parents and teachers in developing expectations for behavior and agreeing on appropriate responses to not meeting those expectations (changing the rules by which the system operates)
- Create a peer mediation program run by students who can help other students learn how to handle conflict and who can discuss students' needs with administrators (enabling the system to change and evolve)

> *To demonstrate the power of rules, I like to ask my students to imagine different ones for a college. Suppose the students graded the teachers, or each other. Suppose there were no degrees: You come to college when you want to learn something, and you leave when you learned it... Suppose a class got graded as a group, instead of individuals. As we try to imagine restructured rules and what our behavior would be under them, we come to understand the power of rules.*
>
> **Donella Meadows, *Thinking in Systems*[11]**

Level 4
Mental Models That Underlie the System

Actions within this level adjust what people inside and outside the system believe and value about the system. Stakeholders' mental models influence decisions, including those about how a system is organized. Actions in this level hold the highest potential leverage because, once the underlying beliefs that inform the design and structure of the system change, the original system would seem unreasonable.

Table 9 below outlines the types of actions that could fall into Level 4.

Does the action...	...adjust the goals of the system?
	...change people's values, beliefs or assumptions about the system?
	...help people see beyond their own values, beliefs or assumptions and explore a different way of being?

Table 9. Level 4 actions.

Level 4 actions are the highest leverage because the people within the system begin to operate from an entirely new mindset that perpetuates different systems behavior.

EXAMPLE

The group developed a list of possible Level 4 actions that might address racial disparities in suspensions.

- Collectively reassess the aims that existing behavioral expectations are intended to accomplish and consider whether and how they support or detract from a positive school climate (adjusting the goals of the system)
- Redesign the advisory program with students to create new opportunities for teachers and students to engage with one another more authentically (helping all stakeholders see beyond their own beliefs, values and assumptions)
- Help teachers view setting expectations and making discipline decisions as relationship-building opportunities (exploring new ways of being)
- Engage teachers in ongoing training about their beliefs around classroom power dynamics, with specific regard to race (changing people's assumptions about the system)

> *People who cling to paradigms (which means just about all of us) take one look at the spacious possibility that everything they think is guaranteed to be nonsense and pedal rapidly in the opposite direction. Surely there is no power, no control, no understanding, not even a reason for being, much less acting, embodied in the notion that there is no certainty in any worldview. But, in fact, everyone who has managed to entertain that idea, for a moment or for a lifetime, has found it to be the basis for radical empowerment. If no paradigm is right, you can choose whatever one will help to achieve your purpose.*
>
> **Donella Meadows, *Thinking in Systems*[12]**

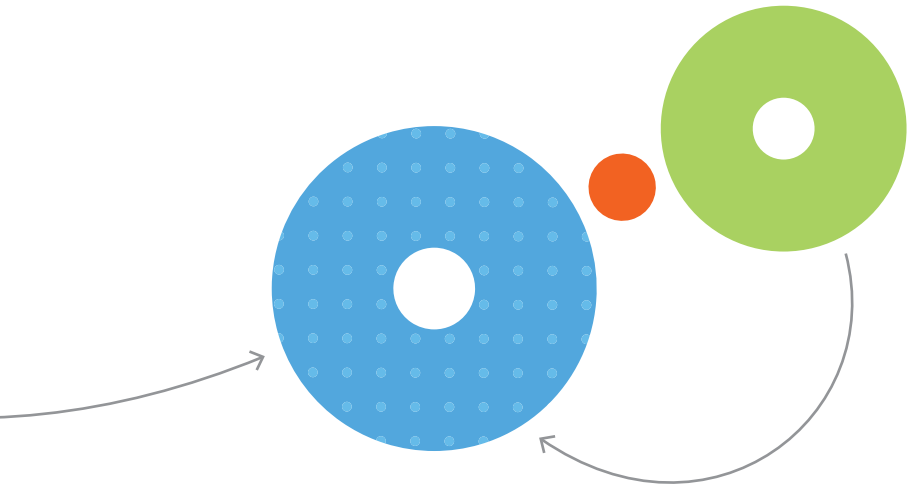
Wrap Up

No solution is perfect. In a systems thinking approach, the context of the system and the desired outcome determine what action is appropriate. Every potential solution will have unintended consequences and tradeoffs that should be anticipated and balanced with how deep and effective the solution might be. In most systems, actions in Level 1 have lower impact. They are much less likely to lead to significant change than are actions in Level 4. However, stakeholders often look to those lower-impact actions, even when they are faced with a deep structural problem, because those actions are more obvious, more prevalent, more widely accepted or easier to execute. High-impact, low-effort actions are ideal, though high-impact, high-effort actions may be appropriate in some cases. From a systems perspective, most efforts do not address the underlying structures of the system, even if those efforts are expensive or difficult to undertake. Such efforts are inherently low leverage because they do not address the structure of the system that is causing its behavior.

Looking for leverage involves categorizing potential actions based on whether they address:

- Components of the system
- Interactions among components
- Structures that determine components' interactions
- Mental models that underlie the system and influence the structures

When we broaden our understanding of the types of actions that we might take to change a system, get clear about the relative level of effort involved and assess the possible intended and unintended impacts of proposed actions, we have new opportunities to make sustainable change and to move our systems closer to our preferred futures.



> *Magical leverage points are not easily accessible, even if we know where they are and which direction to push on them...You have to work hard at it, whether that means rigorously analyzing a system or rigorously casting off your own paradigms and throwing yourself into the humility of not knowing.*
>
> **Donella Meadows, *Thinking in Systems*[13]**

PRACTICE

In this section, you will apply the concepts from "**Lesson 3: Looking for Leverage to Create Change**" to your own context and experiences. Refer to the concepts and example from that lesson for guidance.

The concept of leverage can help inform conversations about systems change and can provide a lens through which to evaluate, discuss, pursue and reflect on proposed initiatives and solutions. The depth-of-impact levels are meant to help push conversations and to help you and your group identify solutions that may not be obvious. Think less about what category potential initiatives and solutions fit into and more about whether any proposed action, either on its own or in concert with others, will address the underlying, structural issues that your system faces.

> *"There is no better time for systems thinking. The complexity of the systems is increasing, and more often, people are coming in with quick-fix solutions with minimal effort to seek a deep understanding of the system and its challenges. We have to make sure that we really understand the systems we are trying to improve before we start trying to change them.*
>
> **Tracy Benson, president**
> **Waters Center for Systems Thinking**

Identifying Actions at Each Level

1. Reflect on your causal loop diagram. Which areas seem most in need of intervention?
2. Develop a list of possible interventions that could address that part of the systems problem.
3. Discuss at which level each of those actions might sit.

   Level 1: Parameters of the System. Actions within this level adjust features of the system without changing any of its underlying structures.

   Level 2: Interactions among Variables. Actions within this level adjust how elements within the system interact.

   Level 3: Structures That Determine the Interactions. Actions within this level adjust the way the system is designed, organized or governed.

   Level 4: Mental Models That Underlie the System. Actions within this level adjust what people inside and outside the system believe and value about the system.

4. Reflect on your categorization. Can your group think of additional Level 3 or Level 4 actions that could address your systems problem? Could any actions from Level 1 or Level 2 be reframed to make them higher leverage?
5. Discuss the following questions:
   a. Which actions do you perceive as being the best fit for the desired change in your system? Do you need to engage in multiple actions at multiple levels?
   b. Which actions would take a great deal of effort, and which would be relatively low effort? How might that change the group's perception of which actions to undertake?
   c. What might be the first steps toward taking any of these actions?
   d. After taking those first steps, when and how might the group reconvene to reflect on the effects of the actions and to revise assumptions about their outcomes?

4 ANTICIPATING FUTURES OF A SYSTEMS PROBLEM

Systems thinking can help stakeholders gain a deep and comprehensive sense of what is happening today and what has happened in the past. It can also help illuminate future possibilities and support our efforts to bring our preferred futures to life.

Though we can never know exactly what will happen, we can articulate our aspirational visions, consider the long-term consequences of our own choices, extrapolate out how trends might play out and anticipate how a range of possible events might send us on a new trajectory. Futures thinking and systems thinking form a powerful combination. Just as we might use causal loop diagrams to better understand our system as it is today, we can also use them to clarify what might exist in the future and to describe what we hope to create in concrete detail.

By exploring the effects of interventions and events on systems problems and envisioning the systems that would need to underpin our aspirational visions, we can engage in informed and creative changemaking.

Exploring the Effects of Interventions

Accepting that every solution or intervention has unintended consequences and tradeoffs is one thing; causal loop diagrams can help stakeholders understand what those consequences and tradeoffs might be. Actions or solutions can be added to a causal loop diagram in the form of new variables. The subsequent diagrams can help stakeholders anticipate whether and how the structure or behavior of the system might change as a result of implementing those actions.

As with the creation of the original causal loop diagram, different people will have different perspectives on how the interventions might affect the system and on what other ripple effects might flow from them. Those perspectives will help stakeholders anticipate a broad range of possible future outcomes and make informed choices about how to move forward.

> *"The future can't be predicted, but it can be envisioned and brought lovingly into being. Systems can't be controlled, but they can be designed and redesigned. We can't surge forward with certainty into a world of no surprises, but we can expect surprises and learn from them and even profit from them. We can't impose our will on a system. We can listen to what the system tells us and discover how its properties and our values can work together to bring forth something much better than could ever be produced by our will alone.*
>
> **Donella Meadows, *Thinking in Systems*[14]**

EXAMPLE: Exploring the Effects of Interventions

The group selected some of the proposed actions and added them to the causal loop diagram to analzye possible intended and unintended consequences of those interventions. For example, the team wondered what would happen if teachers gained more confidence about discipline decisions, a Level 2 action. Though the group members did not yet know what specific intervention they might undertake, they tested out the concept and adapted their causal loop diagram to reflect a scenario in which teacher confidence was self-reinforcing instead of increasing or decreasing alongside incidents of student misbehavior. The causal loop diagram shown in Figure 10 (right) reflects that shift.

In talking about the proposed intervention more, the group realized that, if teachers' level of confidence in handling discipline decisions were no longer influenced by the number of incidents of misbehavior or by their own acknowledgement of bias as it had been in the original diagram, then the racial disparities in suspensions would persist. The group members decided that teachers needed to use any increase in incidents of misbehavior as an opportunity to reflect and refine their teaching practice. They abandoned the idea of trying to address teachers' confidence as an intervention and continued to discuss where they might want to intervene.

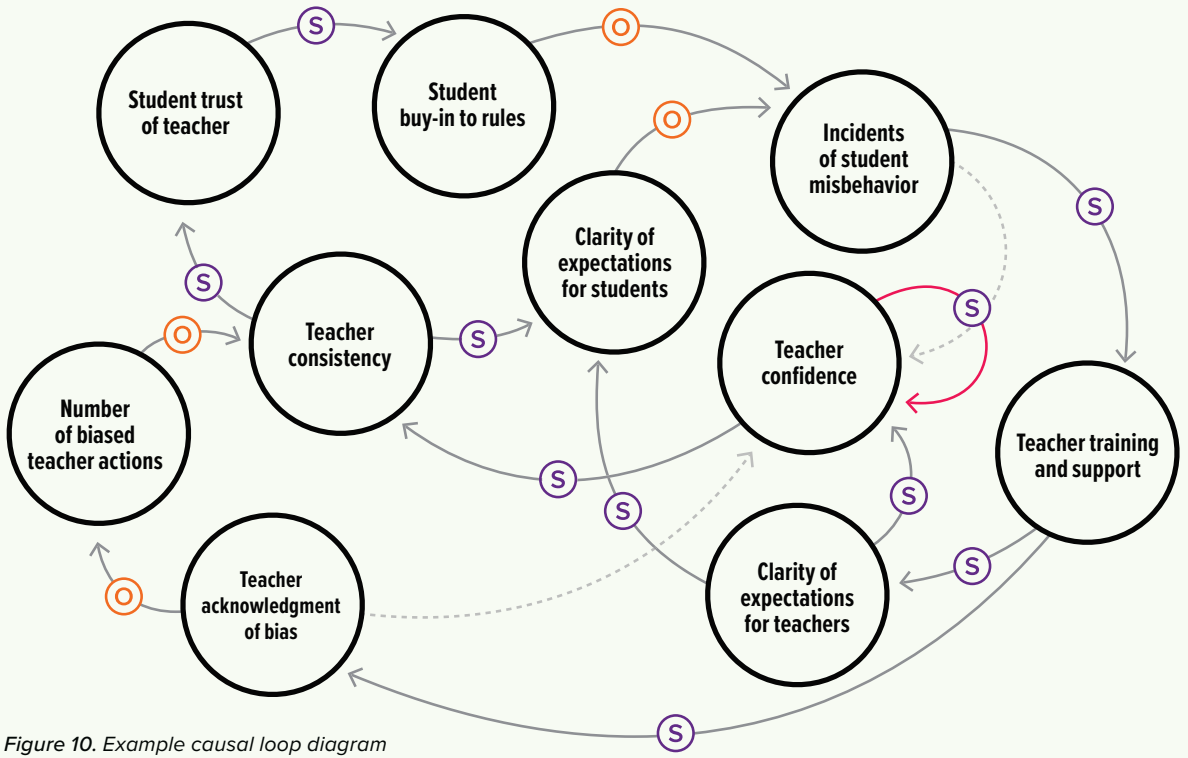


Figure 10. Example causal loop diagram reflecting self-reinforcing teacher confidence.

Ultimately, they decided that the level of support and training teachers received, a Level 3 action, would be a more appropriate leverage point. If teachers had ongoing learning opportunities that focused both on discipline strategies and bias – as opposed to one-time professional development implemented in response to a crisis – then teachers would be more likely to maintain their confidence through setbacks. They would also have regular time and support to process incidents as they arose. The group members discussed whether that training could help teachers reframe their perception of behavioral incidents, coming to view them as data and as relationship-building opportunities, a Level 4 action. The group adapted the original causal loop diagram again, disconnecting training and support from incidents of misbehavior and illustrating the ongoing nature of teachers' learning opportunities. The causal loop diagram shown in Figure 11 (right) reflects that shift.

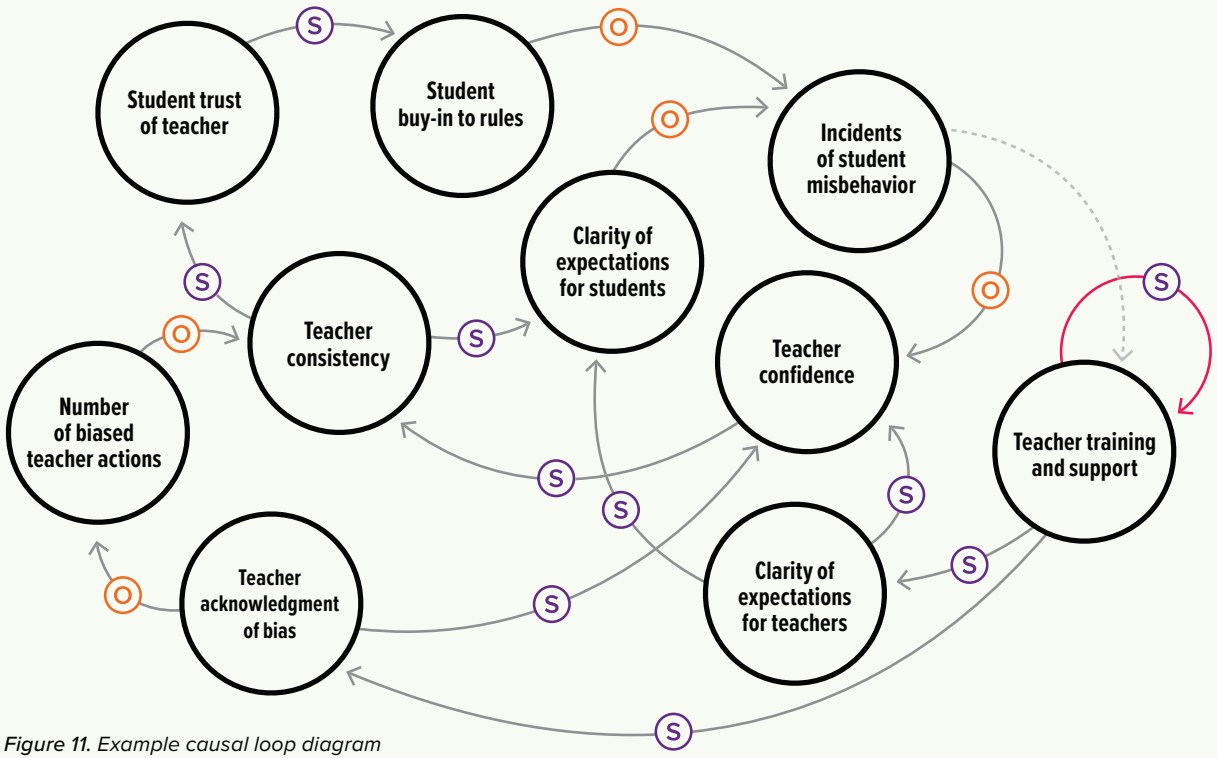


Figure 11. Example causal loop diagram reflecting ongoing learning for teachers

Exploring the Effects of Events

Intentional actions help shape the future, but so do external events. As stakeholders make plans, solve problems and work to understand their systems, they also need to consider how factors outside their control might affect their goals and aspirations. Though stakeholders cannot be certain what will occur, they need to anticipate possible events, consider the effects of events that have already occurred and develop potential responses. Planning in this way reduces surprise and disruption when the external factors change.

The kinds of events that can affect a systems problem are described below.

Plans or intentions

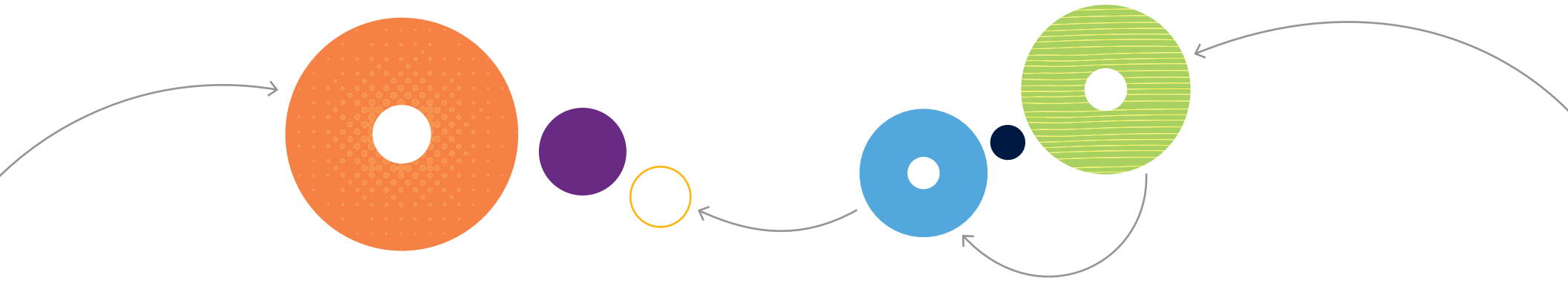
Whether they come from a school district, a policymaker, a philanthropic partner, a major employer or a neighborhood group, the plans and intentions of others also matter. Considering how a proposed external program, policy or decision might affect the system and the problem at hand can improve understanding of future possibilities and effective action.

Current Trends

Changes happening today, such as demographic shifts, increasing environmental volatility and technological advancement, can have major influence over how a school or district might operate in the future. Thinking through what those changes might mean in the context of a systems problem can help stakeholders consider measures that could help them respond.

Future Possibilities

The future is full of events that have yet to occur and of the ripple effects of those that have already happened. Exploring plausible future events, such as a major grant to a region or a natural disaster, and the possible effects of past ones, such as a new housing crisis from an economic downturn or a sharp increase in students' need for mental health services after prolonged social isolation, can help stakeholders understand the need for flexibility and consider strategies for system resilience.



EXAMPLE: Exploring the Effects of Events

The group members wanted to explore the effects of a potential budget cut on racial disparities in suspensions. They could see immediate impact on the availability of training for teachers, but they also saw the possibility that incidents of misbehavior might increase if other resources for students, such extracurricular activities and counseling, had to be cut. As shown in Figure 12 (below), they adapted their causal loop diagram to add "size of budget" and "availability of student supports" to illustrate how those variables might affect traning and student behavior.

The group members agreed to develop an advocacy plan detailing the detrimental effects of a budget cut in order to educate community members and school board members about the essential services that the school provided. They added this idea to their list of Level 4 actions because they believed that it could change people's mental models. They also decided that, in addition to investing in training, they would design systems for peer learning networks within their school so that teachers could continue their professional development even with fewer funds. The group added this idea to the list of Level 3 actions.

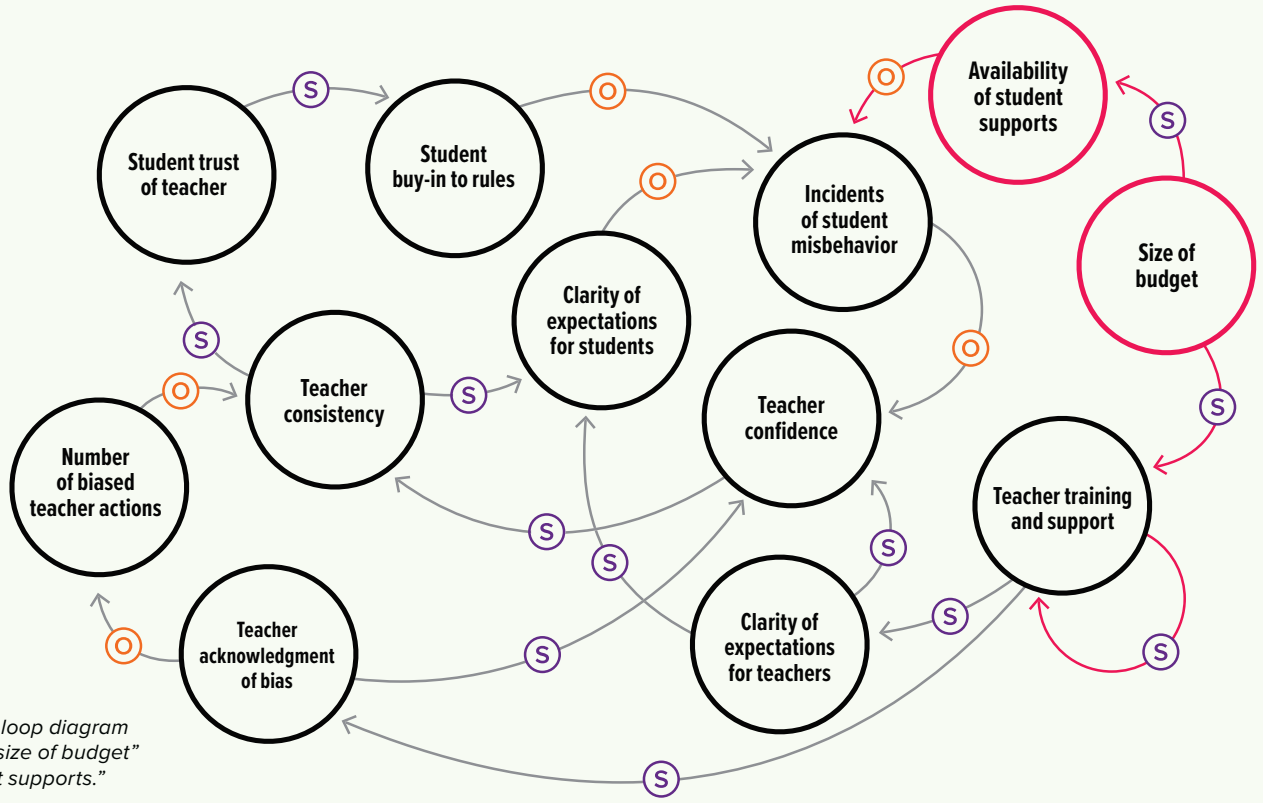


Figure 12. Example causal loop diagram reflecting the addition of "size of budget" and "availability of student supports."

Envisioning a Transformed System

Addressing a problem using the tools, mindsets and processes of systems thinking can lead to new insights about a system and can set the stage for more informed action. Moreover, stakeholders can use systems thinking not only to shift what currently exists but also to articulate what could be. Even when groups hold a shared aspirational vision, they rarely consider and describe the underlying structures that would need to be in place for that vision to be realized. Stakeholders can use the same process used to identify a shared systems problem to clarify their shared preferred futures in a concrete way.

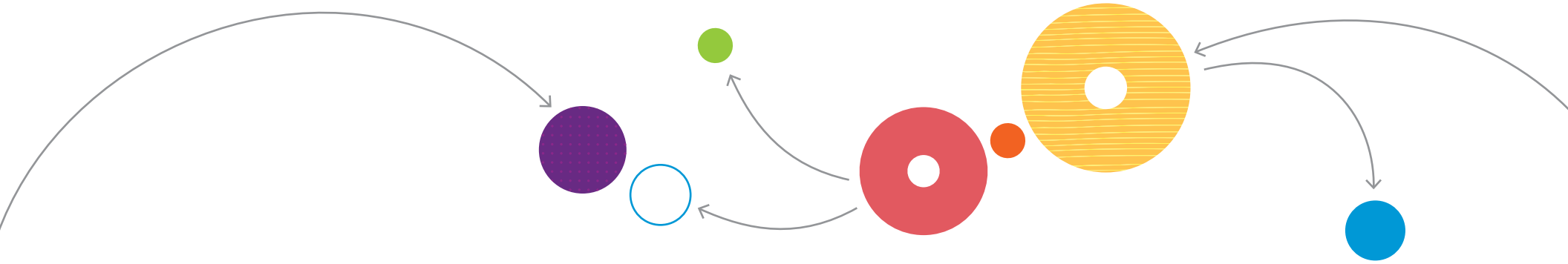
» **What specific systems behavior do people in the system agree they would like to see?** Describing the behavior that would be observable if a system were operating according to a shared ideal can help stakeholders clarify what they want for the future.

» **Who has a stake in the ideal system? Who is contributing, and who is affected?** Considering who would be involved in an ideal system, especially if they are not players in the current system, can open opportunities to engage new stakeholders and to consider roles that would need to exist to make the ideal system function.

» **What factors would contribute to achieving the ideal systems behavior?** As with any systems problem, any ideal system would be underpinned by multiple, related factors that would cause the system's behavior. Reflecting on what would have to be in place to cause the ideal systems behavior can lead to new insights about what a future system might entail.

» **What would happen as a result of achieving the ideal systems behavior?** The larger or longer-term effects of the system's ideal behavior may be surprising and counterintuitive. Anticipating these effects can help stakeholders refine their understanding of their preferred futures and avoid unintended results.

Discussing the structures that would need to exist in a preferred future and visualizing an ideal system can be powerful ways to make a vision more concrete and to reveal the gaps between current reality and stakeholders' aspirations.



EXAMPLE: Envisioning a Transformed System

To articulate what they hoped to see in the future, the group members discussed the same questions that had led them to identify their shared systems problem, responding to those questions with a future lens. They also used the opportunity to discuss their original plan to implement a restorative justice program. While they still believed that such practices would be helpful for their school, they realized that a new program alone would not address the bigger issues that they wanted to solve.

Equipped with several leverage actions and many questions, everyone agreed to come back together in a few months to assess their progress on the agreed action steps, to review the causal loop diagrams that they had created, and to visualize their ideal system in a new causal loop diagram.

What specific systems behavior do people in the system agree they would like to see?
The group envisioned a school and classrooms that fostered a sense of self, belonging and love of learning. Students would feel confident in their own needs and opinions; would have strong, trusting relationships with their peers and adults; and would be learning relevant skills and content. The entire school community would have a role in decision making, and everyone would have an awareness of, and the tools and desire to talk frankly about, racial inequity. Teachers would also be learners and would also have mutually supportive relationships with others in the school community.

Who has a stake in the ideal system? Who is contributing, and who is affected?
The group recognized and felt empowered by the fact that the players in their ideal system would be the same as the players in the current system; they would simply have different roles. Students and parents of color would be seen as experts on their own experiences and would have leadership responsibilities. Teachers would be peer mentors and facilitators of learning for everyone in the system. White parents and students would be learners and advocates as well as allies for equity. As they developed this vision, group members began to see their own responsibilities in transforming their system more clearly.

What factors would contribute to achieving that ideal systems behavior?
New types of relationships among students, teachers, parents and administrators would foster a sense of belonging and sense of self for every person in the system. Opportunities for students and parents to be involved in decision making and for students and teachers to get to know one another would also create a more trusting culture. Students and teachers began to think about what knowledge and skills would be most relevant and how they could develop classroom structures that enabled them to create units of study together. The staff said that having more time to reflect and learn would be a critical factor in being the model learners and leaders they hoped to be.

What would happen as a result of achieving that ideal systems behavior?
Feelings of distrust would decrease, and more communication channels would open. The school environment would be more flexible because it would have more ways for people to participate and would be more responsive to the needs and interests of a wider range of stakeholders. All stakeholders would feel more comfortable being themselves and appreciating others for who they were and what they brought. The group also envisioned some difficult consequences of achieving the ideal, including lack of acceptance from others outside the system and challenges with onboarding new staff or students into an uncommon culture.

Wrap Up

Systems thinking can help us find new ways to look at and address persistent problems of the here and now. It can also serve as an avenue for exploring our highest aspirations. Such exploration is often a more vulnerable conversation that leaves us wondering, "Is that truly possible?" Only by articulating what we hope to see can we begin the long work of transforming our systems.

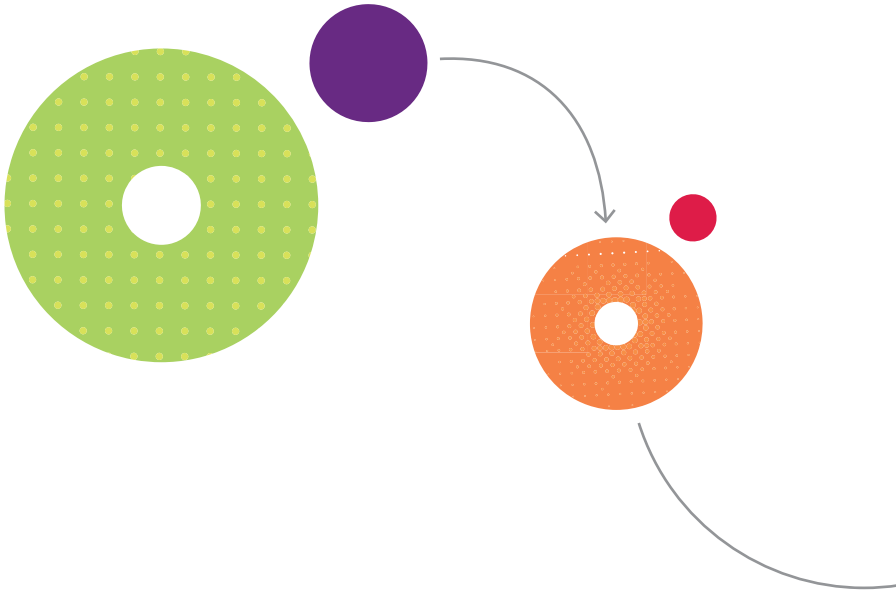
Anticipating futures of a system involves:

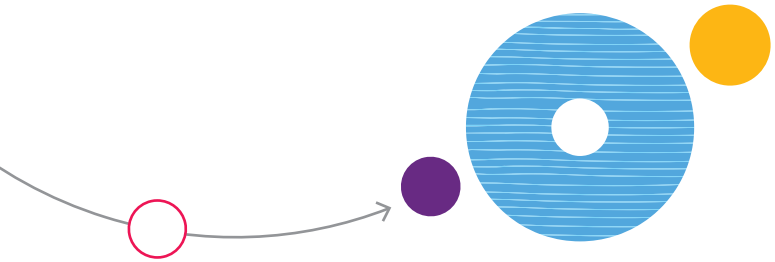
» Exploring possible effects of interventions

» Exploring possible effects of events

» Envisioning the components of a preferred future system

Though the behavior of a system is not always perpetuated by intentional action, we do have the power to change it. Using systems thinking to explore possibilities for the future allows us to imagine our visions in action and to take the first steps toward realizing them.





> *Key stakeholders can engage in a conversation about the future that they are aspiring to create. Although that future hasn't happened yet, they can collectively answer the question, 'What would we point to as concrete evidence that that future had arrived?'*
>
> **Daniel H. Kim, founding trustee**
> **Society for Organizational Learning**

PRACTICE

In this section, you will apply the concepts from "**Lesson 4: Anticipating Futures of a System**" to your own context and experiences. Refer to the concepts and example from that lesson for guidance.

The purpose of this practice is to expand your group's understanding of what might occur in the future and to surface possible consequences and results. You do not need to create a new causal loop diagram for every possible intervention or event. Select the most important and potentially high-impact items and experiment with them in your diagram. For the others, keep them part of the conversation as you analyze and adjust your diagrams over time.

When creating causal loop diagrams becomes part of an organization's practice and norms, planning conversations can become concrete, can illuminate blind spots and can involve new ways of collaborating. Even simple causal loop diagrams can help stakeholders surface and test their assumptions about the future and about the effects of their and others' actions.

Exploring the Effects of Interventions

1. Select one intervention that your group agrees would be high leverage.
2. Create a new causal loop diagram that includes new variables, links and feedback loops that reflect the intervention or add to your existing diagram. As you create the diagram, discuss:
   a. What would happen to the existing links and loops as a result of this intervention?
   b. What new links and feedback loops would emerge?
   c. What overall effect on the system and the shared systems problem can you anticipate resulting from this intervention?
   d. Given this intervention's inevitable tradeoffs, does the group think that it is worth pursuing?
3. Repeat this process for as many interventions as the group agrees might be viable.

Exploring the Effects of Events

1. Create a table modeled after Table 10 (below) to guide your consideration of others' plans and intentions, along with trends and possibilities that may affect your system and the shared systems problem you are working to solve. Use the examples in Table 10 for guidance.
2. Select one or more items from your list that feel particularly important to add to your causal loop diagram. You can work with one item at a time or add multiple new variables to your diagram simultaneously.
3. Frame the plan, trend or possibility as a variable (e.g., degree of pressure to adopt personalized learning, percentage of students who identify as transgender, number of certified teachers in our region, etc.).
4. Create a new version of your causal loop diagram that includes new variables, links and feed-back loops reflecting the plans, trends or possibilities. As you create the diagram, discuss:
   a. What would happen to the existing links and feedback loops as a result of this event?
   b. What new links and feedback loops would emerge?
   c. What overall effect on the system and the shared systems problem can you anticipate resulting from this event?
   d. Given the possible outcomes, how might this group begin preparing for or addressing this event today?

PLANS AND INTENTIONS What programs, policies or decisions might be implemented that would affect your system? Consider plans and intentions at various levels (local, regional, statewide, etc.).	CURRENT TRENDS What changes happening today could affect your system as they continue to unfold? Consider social, technological, economic, environmental and political shifts and frame trends as something that is "increasing" or "decreasing."	FUTURE POSSIBILITIES What questions do you have about the future? Be as specific as possible and consider those possibilities that seem as if they would most affect your system.
Example: *Statewide effort to adopt personalized learning*	**Example:** *Increasing awareness of, and open conversation about, young people's gender identity.*	**Example:** *How might economic shifts change the pipeline of teachers in our area?*

Table 10. Example of exploring the effects of events.

Exploring a Transformed System

1. With your group, discuss your ideal future system. Use the questions below to structure group discussions that aim to clarify and deepen your understanding of your shared vision.
   a. What specific system behavior do people in the system agree they would like to see?
   b. Who would have a stake in the ideal system? Who would be contributing, and who would be affected?
   c. What factors would contribute to achieving the ideal systems behavior?
   d. What would happen as a result of achieving the ideal systems behavior?
2. Locate the nouns in your responses to the questions above and create a list of variables. Together, refine the variables and determine which ones are most important to include in a causal loop diagram.
3. Create a new causal loop diagram that reflects how you imagine this new system would operate.
4. Reflect on your new diagram:
   a. What are the key differences between today's system and this ideal one?
   b. What are the similarities? What already exists that stakeholders could build upon?
   c. What new assumptions, mindsets or beliefs would need to be in place for this ideal system to become a reality?
   d. Where might you begin bringing forth this new system?

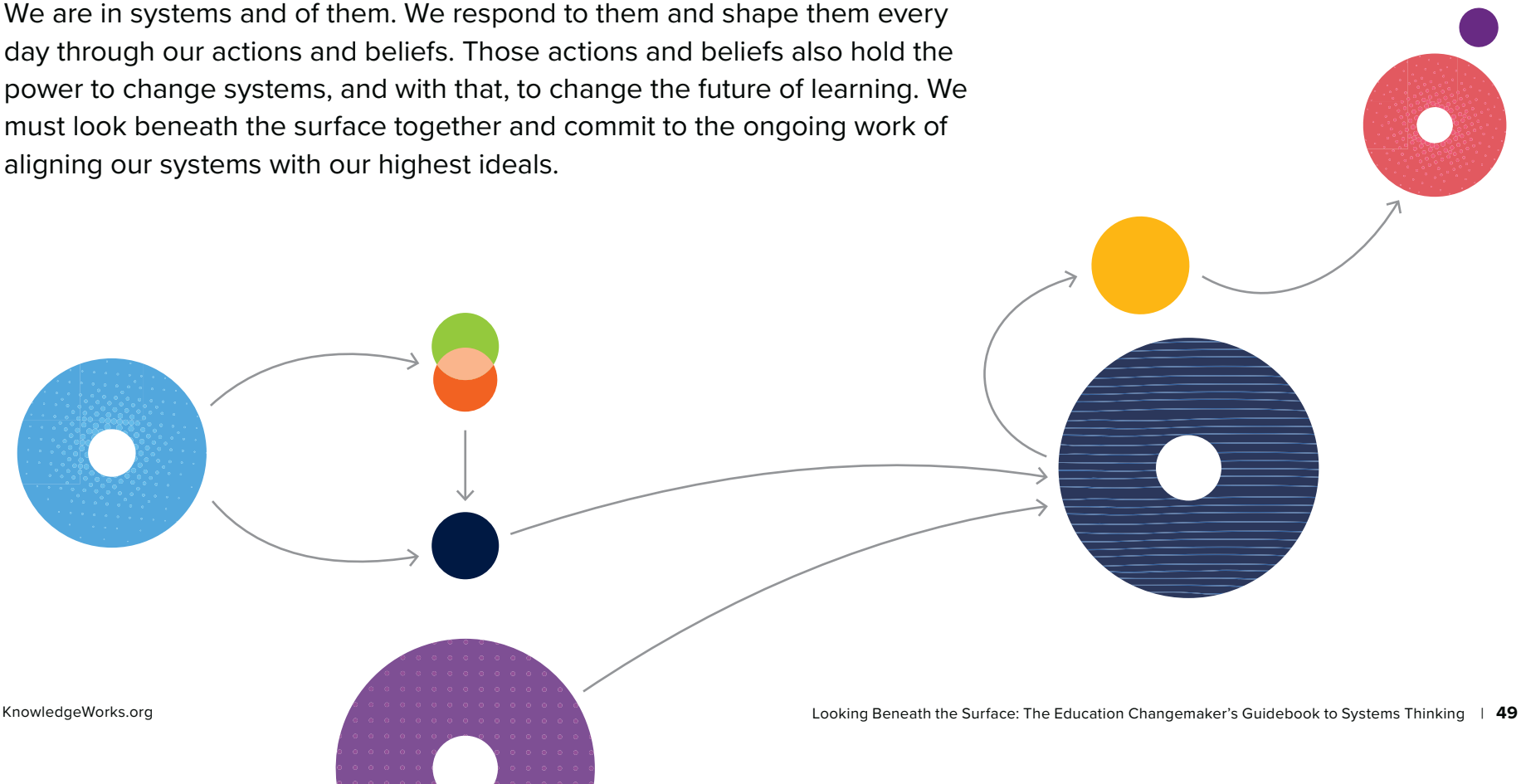
> *It's easy to sit in a room with the highest-paid people to make the decisions. But those decisions have unintended consequences for those who aren't in that room. For me, the most important thing is to consistently engage everyone who matters within the system. It can't be done in isolation.*

Trevor Hicks, program associate, SkipNV, and Harris-Stowe University senior studying secondary education

LOOKING BENEATH THE SURFACE

Any system will achieve the results it is designed to achieve. When those results are not aligned with our preferred futures of learning, we have an obligation to learn more about the system that is producing those results and to make every effort to change it. Decades of well-intentioned education reforms prove that we cannot achieve sustainable change without addressing the fundamental structures of our systems. Education stakeholders need a different set of tools and mindsets to inform their change efforts. Systems thinking offers a place to begin as well as a practice that can inform ongoing organizational learning

We are in systems and of them. We respond to them and shape them every day through our actions and beliefs. Those actions and beliefs also hold the power to change systems, and with that, to change the future of learning. We must look beneath the surface together and commit to the ongoing work of aligning our systems with our highest ideals.



Resources

The following resources provide additional perspectives and detail on systems thinking and its applications.

Key Resources

Systems One: An introduction to systems thinking by Draper Kauffman (PDF book with an appendix of 28 systems rules)

The Fifth Discipline: The Art and Practice of the Learning Organization by Peter M. Senge (book that puts systems thinking in the context of business and learning organizations and includes case studies)

The Systems Thinker (online collection of articles and blogs about systems thinking)

Thinking in Systems by Donella Meadows (book with comprehensive overview of systems thinking and guidelines for working with systems)

The Waters Center for Systems Thinking (website with free systems thinking practice exercises and guidance on using the tools with stakeholders)

Systems Thinking Basics

A Systems Thinking Primer (online overview of the key concepts of systems thinking)

Beyond Connecting the Dots by Gene Bellinger and Scott Fortmann-Roe (online learning environment with interactive models)

Systems and Us (website with overviews of systems thinking and real-world examples of systems at work)

"Tools for Systems Thinkers: The 6 Fundamental Concepts of Systems Thinking" by Leyla Acaroglu (blog post that outlines six major themes and principles of thinking in systems)

Systems Archetypes

"Systems Archetypes I: Diagnosing Systems Issues and Designing Interventions" by Daniel Kim (article that describes systems archetypes with real-life examples and accompanying casual loop diagrams)

"Systems Archetypes II: Using Systems Archetypes to Take Effective Action" by Daniel Kim (article that builds upon "Systems Archetypes I" to provide guidance on identifying and dealing with archetypes at play in real-life)

The Way of Systems (a web-based taxonomy of the relationships among systems archetypes, with explanations of each)

"Tools for Systems Thinkers: The 12 Recurring Systems Archetypes" by Leyla Acaroglu (blog post that outlines nine common systems archetypes and three less-discussed positive archetypes)

Applying Systems Thinking

"Leverage Points: Places to Intervene in a System" by Donella Meadows (blog post that served as the foundation for the leverage section of Meadows' Thinking in Systems)

"Systems Approaches to Public Sector Challenges: Working with Change" by OECD Observatory of Public Sector Innovation (report that highlights how systems thinking can be incorporated into policy processes with examples from four countries)

Systems Thinking for Social Change by David Peter Stroh (book that offers guidance on incorporating systems thinking into social systems work and shares real-life examples)

The Habit-Forming Guide to Becoming a Systems Thinker by Tracy Benson and Shari Marlin (book that details and provides practice for the habits of a systems thinker developed by the Waters Center for Systems Thinking)

Systems Thinking in Education

"Beyond Design Thinking: Why Education Entrepreneurs Need to Think in Systems" by Amy Ahearn (blog post that outlines how one pair of education innovators used systems thinking to inform their design process)

"Developmental Stories: Lessons of Systemic Change for Success in Implementing the New Common Core Standards" by Tracy Benson, Michael Fullan, Robert Kegan, Claudia Madrazo, Joanne Quinn and Peter Senge (report that uses implementation of the Common Core State Standards as a lens for exploring ongoing learning and systems understanding in schools)

"How Systems Thinking Applies to Education" by Frank Betts (journal article that compares systems approaches to popular approaches to education changemaking)

"Revitalizing the Schools: A Systems Thinking Approach" by Colleen Lannon (blog post that describes efforts to bring systems thinking into classrooms and school systems)

"The Many Faces of Systemic Change" by Charles Morgan Reigeluth and Kurt Squire (journal article that outlines how systems change is defined at different levels in education)

Systems Thinking and Equity

"Equity-Centered Capacity Building: Essential Approaches for Excellence and Sustainable School System Transformation" edited by Sheryl Petty (collection of articles that explores various approaches to transformation, including an article on systems thinking and equity)

"Systems Primer" by Stephen Menedian and Caitlin Watt (report from Kirwan Institute for the Study of Race and Ethnicity that outlines systems thinking basics in the context of race)

"Systems Thinking and Race" by john a. powell, Connie Cagampang Heller, and Fayza Bundalli (a workshop summary of conversations about structural racism and systems-based approaches to dismantling them)

"Systems Thinking and Racial Justice Featuring Professor john a. powell" (webinar exploring how systems thinking can inform racial justice efforts)

Diagramming and Modeling Tools

Insight Maker (web-based, free)

Kumu (web-based, free with premium options)

Loopy (web-based, free)

Vensim (downloadable, paid)

Endnotes

1 A summary of strategies related to change management in education can be found in Managing change in education: Practical strategies to improve change outcomes in K-12, RTI International, 2019, https://www.rti.org/publication/managing-change-education/fulltext.pdf.

2 More information about the habits of a systems thinker can be found in Habits of a Systems Thinker, The Waters Center for Systems Thinking, 2020, https://waterscenterst.org/systems-thinking-tools-and-strategies/habits-of-a-systems-thinker.

3 More information about authentic collaboration and stakeholder engagement can be found in Visioning Toolkit: Laying the Groundwork for a Community-Wide Vision for Personalized Learning, KnowledgeWorks, 2018, https://knowledgeworks.org/resources/toolkit-community-wide-vision-personalized-learning/ and Developing Shared Ownership for Personalized Learning, KnowledgeWorks, 2019, https://knowledgeworks.org/wp-content/uploads/2019/05/shared-ownership-personalized-learning-policymakers-knowledgeworks-spf.pdf.

4 Unless otherwise indicated, all quotes are excerpts from interviews conducted by the authors.

5 Sterman, J.D. (2002, May). System Dynamics: Systems Thinking and Modeling for a Complex World. Engineering Systems Division Working Papers Series. Camridge, MA: Massachusetts Institute of Technology. Retrieved from https://dspace.mit.edu/handle/1721.1/102741.

6 Acaroglu, L. (2017, September). Tools for Systems Thinkers: Recurring Systems Archetypes. Medium. Retrieved from https://medium.com/disruptive-design/tools-for-systems-thinkers-the-12-recurring-systems-archetypes-2e2c8ae8fc99.

7 See the “Resources” section of this paper for digital causal loop diagramming tools.

8 Meadows, D. (2008). Thinking in Systems. White River Junction, VT: Chelsea Green Publishing.

9 Meadows, D. (2008). Thinking in Systems. White River Junction, VT: Chelsea Green Publishing.

10 Meadows, D. (2008). Thinking in Systems. White River Junction, VT: Chelsea Green Publishing.

11 Meadows, D. (2008). Thinking in Systems. White River Junction, VT: Chelsea Green Publishing.

12 Meadows, D. (2008). Thinking in Systems. White River Junction, VT: Chelsea Green Publishing.

13 Meadows, D. (2008). Thinking in Systems. White River Junction, VT: Chelsea Green Publishing.

14 Meadows, D. (2008). Thinking in Systems. White River Junction, VT: Chelsea Green Publishing.

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Acknowledgements

Many thanks to Xiang Yu for her research and writing support; to Andrew Frangos, Trevor Hicks, Morgan Kauffmann, Daniel H. Kim, Allie Simpson and Jenny Zhou for the time and knowledge shared during interviews and review of this paper; to Tracy Benson and Alexis Kieft from the Waters Center for Systems Thinking for their thought partnership; to KnowledgeWorks colleagues Mike Ball, Virgel Hammonds, Laura Hilger, Anne Olson, Karla Phillips-Krikivas and Matt Williams for their feedback on the content; to Todd Garvin for creating the design; and to Kate Westrich and Sean Andres for managing the publication's production and release.

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KnowledgeWorks is a nonprofit organization dedicated to advancing personalized learning that empowers every child to take ownership of their success. With 20 years of experience exploring the future of learning, growing educator impact and working with state and federal policymakers, our passionate team partners with schools and communities to grow a systemwide approach to sustain student centered practices so that every child graduates ready for what's next. Learn more at KnowledgeWorks.org.

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