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Understanding Systems from a Feedback Perspective

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METHODS BRIEF SERIES 1.05

Systems perspectives encourage us to see the world as an interconnected system of causal relationships. A fundamental idea of system dynamics perspective the focus on feedback thinking – looking at cause and effect as not just moving in one direction. The purpose of this brief is to introduce the concept of feedback thinking through the lens of challenges in K-12 education, and present Causal Loop Diagrams as tools to describe feedback relationships between components of a system

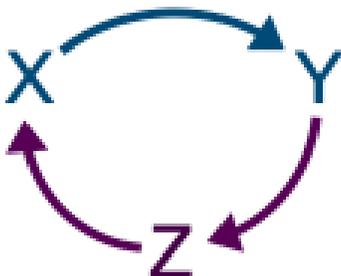
+Linear vs. Feedback Perspective

Linear Thinking:



In many fields, we are conditioned to approach problems through linear thinking, which we could also call “event” or “cause-effect” thinking. When looking at problems, we look for causal relationships in one direction: “X” causes “Y”. If we take action on “X”, logic suggests we will expect a direct effect on “Y”. We list all the factors that influence the outcome we want to change, and launch interventions to address each one in order to create a comprehensive strategy.

Feedback Thinking:



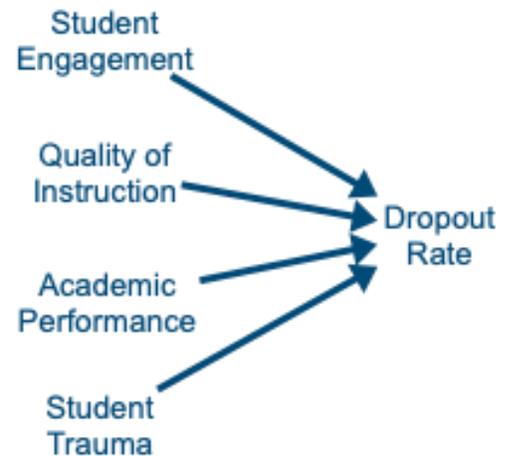
In contrast, the feedback perspective complicates this idea of “X” causes “Y”. Feedback thinking recognizes relationships and interdependencies between the parts. Using feedback thinking, we look for causal relationships in both directions. Rather than addressing factors in isolation, we look to feedback structure to understand why problems persist despite our best efforts – why we might push on one part of the system and see a response in another, in sometimes unexpected ways. When designing interventions using feedback thinking, we seek to change the structure of the system by adding or removing feedback loops; strengthening or weakening loops, and adding or removing links.

+AN EXAMPLE OF LINEAR VS FEEDBACK IN EDUCATION

In this example, a school district has a dropout rate of 10% - nearly double the national average. District leadership sets a goal to reduce the dropout rate by 5% in the next three years.

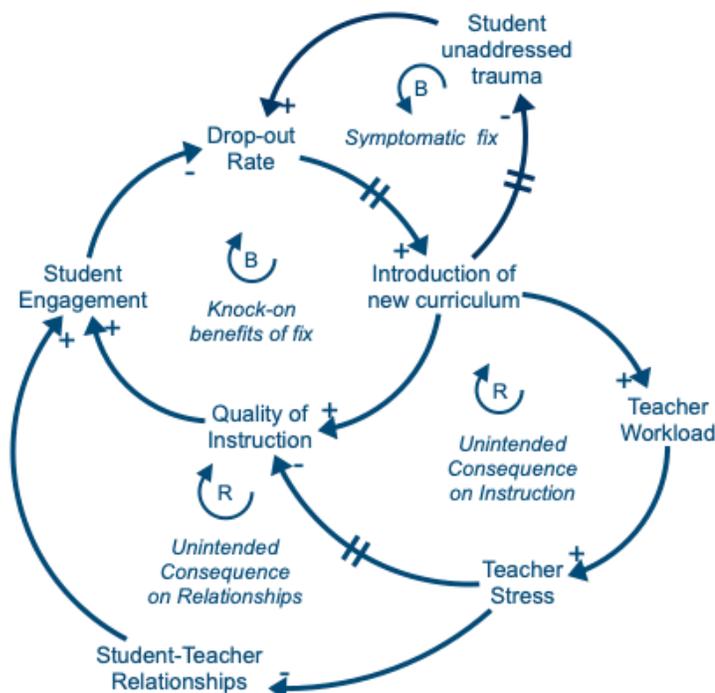
Approach 1: Linear Thinking

The leadership team discusses the factors they believe are associated with the rise in dropouts: low student engagement, poor teacher performance, low academic performance, and high levels of student trauma. To solve the problem, they decide to introduce a new, intensive, trauma-informed district-wide curriculum. The idea is that the new curriculum will directly address student trauma, and intensive training will strengthen teacher performance, resulting in more student engagement and academic performance. The curriculum seems to be working at first, decreasing the dropout rate in Year 1. However, by the end of the three years, the dropout rate is even higher than where it started.



Approach 2: Feedback Thinking

The leadership team takes a step back to examine the intervention more holistically, through a feedback lens. They convene a group of administrators, students, staff and parents to build a **Causal Loop Diagram** to describe the multiple consequences of the new curriculum strategy



The resulting Causal Loop Diagram tells a story about why prior efforts to reduce dropout rates were unsuccessful in the long run: As dropout rates increased, the district introduced the new curriculum with the intent to improve quality of teaching, increase student engagement, and therefore reduce dropout rates (“Short-term fix”). However, the new curriculum has a side effect - it significantly increases the workload of the already overwhelmed teachers. Over time, the teachers become increasingly burnt out and stressed, undermining their quality of teaching and exacerbating the dropout rate (“Unintended Consequence on Instruction”). Furthermore, as teachers become more stressed, they are unable to build and maintain strong relationships with students at-risk of dropping out. Consequently, students became less engaged and the dropout rate increases even further.

Conclusion

This CLD of course doesn't tell the whole story. But as this story illustrates, linear, cause-effect thinking can obscure hidden sources of "policy resistance" – ways that a system pushes back to resist efforts at change. A feedback lens helps us think through why interventions may have undesirable results even in situations where we are highly motivated and have the right technical knowledge.¹

+ HOW TO READ A CAUSAL LOOP DIAGRAM

A causal loop diagram is a visual hypothesis of how components or factors in a system are interconnected in such a way that generate the system behavior we see. The blue arrows represent causal links between variables. Hash marks in the blue arrows indicate a time delay. The small "+" or "-" next to the blue arrows describe the polarity, or directionality of the relationship between the variables linked together:



Positive Causal Link: There is a direct relationship ("+") between the two variables *Quality of Instruction* and *Student Engagement*. As *Quality of Instruction* increases, *Student Engagement* increases. The opposite is also true: As *Quality of Instruction* decreases, *Student Engagement* decreases. The variables are changing in the same direction.



Negative Causal Link: There is an inverse relationship ("-") between the variables *Student Engagement* and *Dropout Rate*. As *Student Engagement* increases, *Dropout Rate* decreases. The opposite is also true: as *Student Engagement* decreases, *Dropout Rate* increases. The variables are changing in opposite directions.

The "R" and "B" embedded in circular arrows represent feedback loops. Feedback loops describe system behavior in which an initial change in a variable causes a chain reaction that ultimately feeds back to create further change in the initial variable. Feedback loops can take two forms: reinforcing and balancing:



Reinforcing loops are commonly known as virtuous cycles or vicious cycles. In other words, a change in an initial variable follows around a loop to amplify the direction of that initial change.



Reinforcing loops are commonly known as virtuous cycles or vicious cycles. In other words, a change in an initial variable follows around a loop to amplify the direction of that initial change.

+ CONSIDERATIONS

- A causal loop diagram (CLD) is a systems thinking tool to help us approach problems from a feedback perspective. Remember, a CLD is a hypothesis– there is not one single "right" answer to the variables that are included or the relationships that exist between them. The model we produce is informed by each of our individual mental models, which come from our unique vantage point and lived experiences

in the system. In the example above, a teacher may have immediately identified the variables of teacher workload and teacher stress, whereas students may have been attuned to student-teacher relationships and their level of engagement. The beauty of creating a causal loop diagram comes when you can share it with others so it can be refined, negotiated and improved.

- Causal loop diagramming takes practice! Often we start developing a diagram and have variables that don't actually vary, and causal links that are more like associations or correlations. The goal of using these tools is to fine tune your thinking, rather than get it "right" on the first time.

+ GETTING STARTED

- Think of a complex problem you want to address in your work or life. What are some of the causes of that problem?
- Where can you identify potential feedback effects, where an initial causal link feeds back to form a loop? Try to draw a feedback loop using the conventions above.
- How does feedback propose different ways of looking at potential solutions than linear or cause-effect thinking?
- How do you see this concept fitting into your teaching/facilitation/management/leadership?

+ ACKNOWLEDGEMENTS

- The examples and stories in this brief draw from work with teachers in the Systems Thinking for Education Equity Partnership (STEEP), and with students and staff at Ritenour High School.

+ SOURCES

1. Sterman, J. D. (2000). *Business dynamics: Systems thinking and modeling for a complex world*. New York, NY: McGraw-Hill Education.

+ SUGGESTED CITATION

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+ ABOUT THE SERIES

Social System Design Lab Methods Briefs are short, digestible notes on applications of system dynamics and systems thinking in community settings. They are meant to capture and share out our current thinking on core ideas.

"Series 1: Systems Thinking Foundations" focuses on introducing core concepts of systems thinking and system dynamics as they relate to issues of educational equity. This series draws from community-based modeling work with educators and students over the last ten years. Other briefs in this series include:

- Systems Thinking Iceberg | **1.01**
- Characteristics of Complex Problems | **1.02**
- Mental Models | **1.03**
- Framing Dynamic Problems | **1.04**
- Accumulation | **1.06**
- System Archetypes | **1.07**

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