the Creative Learning EXCHANGE

Volume 4, Number 2 - Spring 1995

STEVE'S DILEMMA

by Maury Cotter and Daniel Seymour and Joe Sensenbrenner

Most people think and act in straight lines—simple, cause-effect chains. A systems perspective, in contrast, teaches us that reality is made up of circles. These circles of influence have dramatic impact on how organizations behave, how leaders make decisions, and, in some instances, can even explain how international crises are made manifest. But can a systems diagramming exercise explain the dilemma facing a first-grader?

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Steve was excited about starting school. He loved to learn. As a baby he would study a toy for hours, turning it, tossing it, squeezing it, chewing on it. At four, he took apart the baby's swing and put it back together using his dad's tools. It was a bit lopsided after that, but Steve was sure his baby sister was getting a better ride.

Steve's parents were very proud of him. They supported and encouraged his learning, taking him to science museums, letting him use tools on real things (within limits), and answering his never-ending questions.

In kindergarten he was always the first to finish the hardest puzzles. He figured out the mental problems before anyone else understood the question. They just seemed to click in his mind. And the learning games on the class computer were fascinating for him. He would just work the keys, turning the problems around and around, and the answers would seem to pop out. It was the active learning he enjoyed so much—doing things, making stuff work out.

Steve skipped off to the first day of first grade with the same enthusiasm. He had his own desk! He got busy setting it up with his brand new notebooks, crayons, ruler, dinosaur eraser, and squeeze bottle of glue. Ready to go. Ready to learn more.

He wanted to do well. So he sat as still as he could.

But his legs seemed to want to walk away. They would jump around and itch, and his arms would reach and stretch. His teacher asked him to please sit still and not distract the others.

She passed around work sheets and asked the students to print all the letters in the right spaces, as neatly as possible. They would be graded on their neatness and their ability to follow instructions exactly.

Steve worked very hard. His letters were awkward looking. He erased them and tried again. Each time he erased his paper looked worse. And his hands got harder to control. An intense feeling of frustration welled up inside him, and he wanted to smash his pencil through his desk. He wanted to run down the hallway, to let his legs and arms stretch and pump.

When the class finished the sheet, Steve sighed and got ready to get up. But the teacher handed out another sheet. The students sat at their desks for two whole hours before they went to recess that day. After lunch, they moved into work groups for awhile, but they stayed at their desks most of that day. And the next day. And the next.

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Gloria was Steve's teacher. It was her third year teaching first grade. She viewed first grade as a formative year—laying a foundation for all the school years ahead. In first grade you learn to read. You learn basic math. You are a real student for the first time.

She knew it was an adjustment for kids who were used to less structure. But they would have to adapt if they were going to make it in school. Discipline was necessary in body and mind if they were to learn to read, write, and do math. So she was precise and firm, and she set the expectations clearly at the beginning.

She graded the first papers to set the tone. She wanted the students to know what was important and what level of work she expected.

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Steve got the first work sheets back. They had a lot of red on them. Red felt-

***DILEMMA** continued on page 3*

UP-DATES...

CC-STADUS

(Cross-Curricular Systems Thinking and Dynamics Using STELLA)
A NSF funded teacher training project in Portland, Oregon

The CC-STADUS project continues to do well at what it was started to do—train teachers and give them support during the year. Their second summer of training 35+ teachers went very well. Their pattern is to train one summer and then use some of the teachers from that summer to help train the next summer. This is a method of giving two summers of professional development experience to some teachers—and they gain the powerful advantage of learning through teaching. Using this method, they have been very successful in encouraging many of the teachers whom they have trained to put to use what they have learned during the summer. Most of their teachers do at least one unit using system dynamics during the school year, and many of them have used system dynamics as a construct multiple times.

Your editor was in Oregon for a visit to the project (as well as to speak at the Confederation of Oregon School Administrators). I was lucky enough to observe at three different schools: Wilson High School, Franklin High School and LaSalle High School. Diana Fisher and Ron Zaraza are respectively denizens of the first two. In each of those I saw active modeling classes with students engrossed in trying to attain enough of a grasp on real life problems to model them. The problems ranged from the speed of a baseball when thrown to forestry environmental issues to the impact of state law on public education. One thing that is always interesting to note is the high degree of involvement evidenced in classes where students are engaged in using system dynamics. It is impressive and heartening to see.

The third school your editor visited was LaSalle High School. Two teachers at LaSalle, Teresa Hazel and Timothy Joy, took the CC-STADUS training in the summer of 1993. Teresa, at that point, was a neophyte to the Macintosh computer as well as to STELLA. It is impressive to see what two dedicated, intelligent, and energetic teachers can do (it is important to note that they have very good administrative support). Teresa is using models she and others developed in her physics classes and hopes to branch out next year to encourage more extensive use of modeling throughout the science department. Timothy is using modeling in his English classes (see *Lord of the Flies* in the new List of Materials) and is grappling with the issues of making sure that every student at LaSalle has contact with system dynamics in their classes as they go through the school. Both of these teachers are combining the use of the systems tools in the classroom with the broader outlook of the whole system—the school. An unbeatable combination.

Any questions or conversations should be directed to: Diana Fisher at Franklin High School, 5405 SE Woodward St., Portland, OR 97206 or Ron Zaraza, Wilson High School, 2544 SE 16th Ave, Portland, OR 97202.

UPDATES *continued on page 8*

FROM THE EDITOR. . .

In our final newsletter of the school year, we have taken a bit of a departure from our usual lead articles, one I hope you will be interested in and enjoy. Instead of looking at curriculum, this article takes a broader view about what happens to kids in education today. It uses causal loop diagrams to help the reader delineate the issues involved. Further stories about our current educational system and what happens within it are contained in the book Kidgets referenced at the end of the article. Many of them would be terrific for practice making computer models or in drawing your own loops.

One of the updates contains the graphic depiction of the Systems Education Consortium's workshop series facilitated by Gould-Kreutzer Associates. The skill of Don Seville, with help from others in Gould-Kreutzer, has brought the concerns about scheduling into the context of change within school systems. The next step will be to develop a small STELLA model from the loops, which I hope to share with you in the next issue. I think that you will enjoy looking at the causal loop diagrams and figuring out how you would change them. I would love to hear your comments!

I was thrilled to learn about the Blair Magnet Program in Silver Spring, Maryland from Lola Piper. A report on what they are doing is included. I'm sure it will pique your interest as much as it did mine.

I hope that others are using their systems modeling or thinking skills to start to look a the underlying issues within school systems, such as the ones discussed in these articles. If you have and wish to share them, please send them on. If you find them useful, others will too.

Have a good summer, learning, relaxing, and enjoying the world around you.

Lees Stuntz. Editor (stuntzln@tiac.net)

STEVE'S DILEMMA, *continued from page 1*

tip pen that didn't erase when he made the changes. The red showed how his letters were supposed to look and where he had gone "out of bounds." He didn't want to take his paper home to his parents, so he crumpled it up and left it in his locker.

The second week Gloria had each child read to her individually. In the third week she announced the reading groups. Jamie and Sally, Steve's best friends, were put in the red group. Steve was in the blue group. Steve liked the kids in his group, and he liked the stories. But he could see right away that the red group was for smarter kids. At least he wasn't in the "dumb" group. He wondered what it all meant.

They started having timed tests on their math facts. Steve knew the answers, but his pencil wouldn't go as fast as his mind. His paper was an absolute mess, and got some marked wrong just because the teacher couldn't read the answers.

Then his first report card came. Steve got a "satisfactory" in all areas. Jamie got four "outstandings," and Sally got five.

Steve was confused. His parents were concerned. They asked whether he was trying hard.

At conferences, Gloria told Steve's parents that Steve seemed to be bright but that he needed to be more careful with his work. And he needed to learn to sit still.

So Steve tried even harder. He gave up spending extra time on the things he enjoyed learning and tried to focus on doing a good job on those things his teacher wanted to improve.

His second report card was the same.

Steve was mixed up. Thoughts ran around and around. Maybe he wasn't as smart as he believed. His parents thought he was smart. And now he was disappointing them. Maybe the teacher was wrong. Maybe they didn't really know anything about him.

Steve was struggling with two thoughts, and it seemed that only one could be true. Either he was not as smart as he thought he was, or the teacher and the school were wrong.

*If he believed the school was wrong, at least then he could believe in himself.**

* This story is from *Kidgets: and other insightful stories about quality in education* by Maury Cotter and Daniel Seymour (Milwaukee, WI: American Society for Quality Control), 1993. Permission granted.

At the root of Steve's dilemma is his teacher's apparent belief that there is one way to teach/learn. Gloria is causing Steve—a naturally motivated learner—to doubt his ability. He is being forced to accommodate two very different views of his first-grade world: either he is not OK and needs to change or his teacher is not OK, in which case he should fight back. Interestingly, while Steve is faced with a dilemma, either pathway he chooses tends to reinforce Gloria's belief.

Let's look at the "I'm not OK" path as a looping exercise. At the bottom of the loop (R1) is Gloria's belief—there is one way to teach/learn. She also

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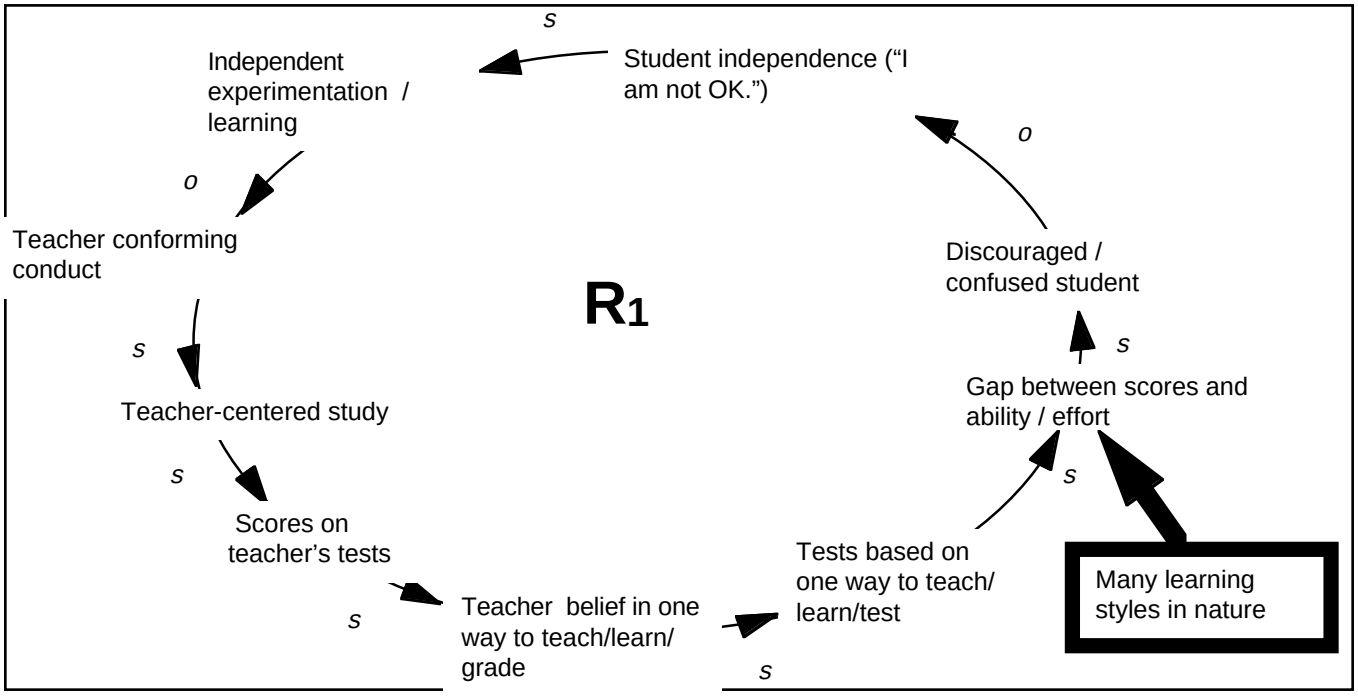


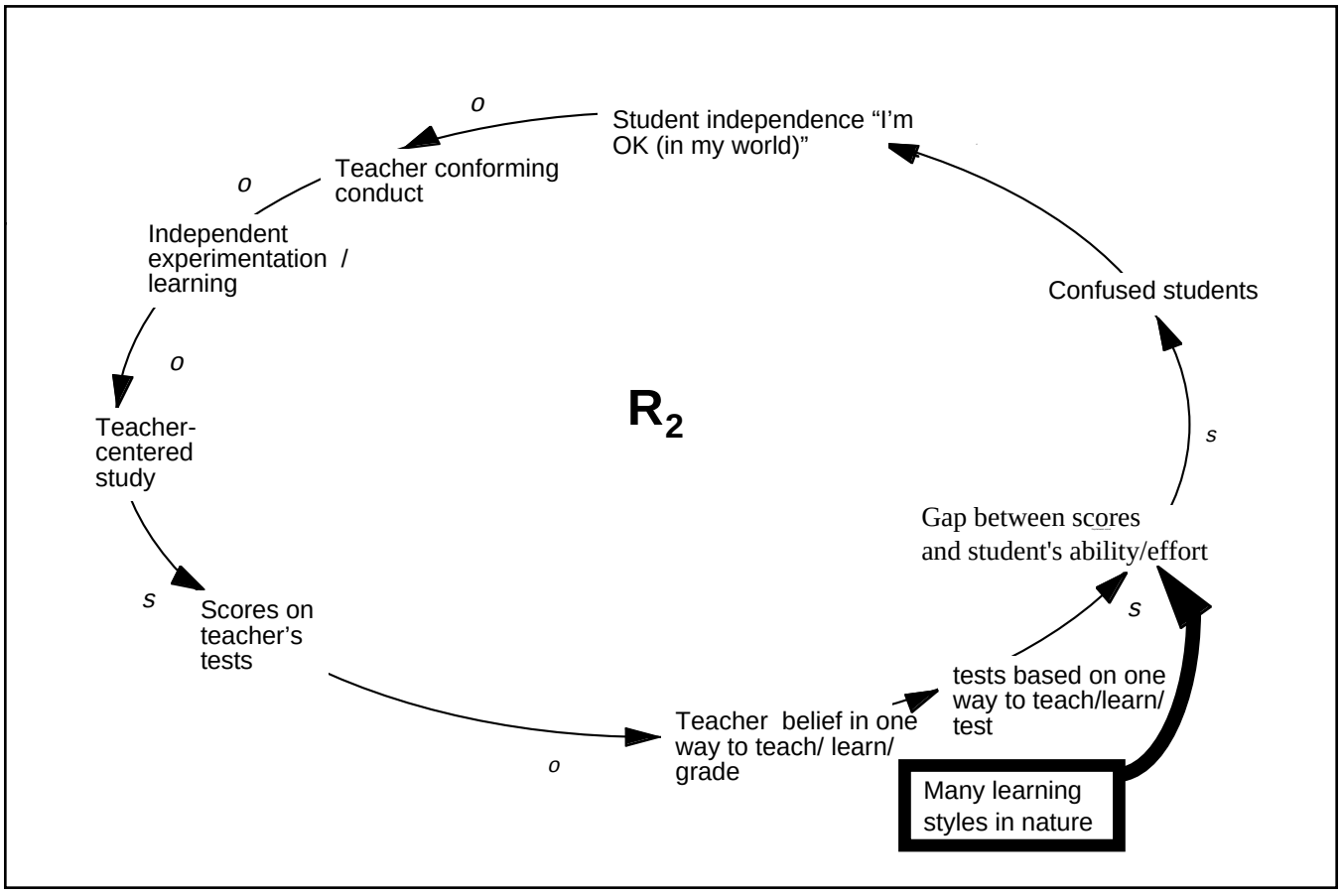
STEVE'S DILEMMA, *continued from page 3*

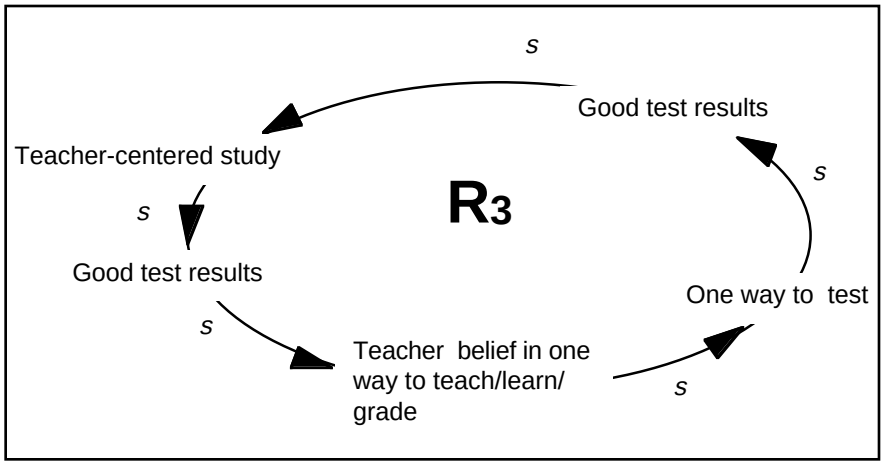
evaluates learning with one type of process: tests that are consistent with that one way. Steve doesn't do well using his teacher's approach to teaching/learning/testing and experiences a gap between the scores he receives and his self-perceived ability. This gap is apparent to him because he has had success in his earlier self-directed experimental learning. He becomes confused and worried. He questions himself and concludes that he is not OK. He reduces his experimentation and "knuckles down" to the tasks prescribed by his teacher. The gap between effort and only marginally better results leads Steve to become more discouraged, lose more confidence, abandon more independent activities, and concentrate on only what the teachers wants.

Gloria, seeing hard work and somewhat better grades, is comforted that her single method is working and rededicates herself to its exclusive application.

Steve, however, might reach a different conclusion and take a different path, the "I'm OK, you're not" one. Again, looking at the bottom of R2, the teacher believes in one way to teach/ learn and presents material in that way. The initial set of variables and links proceed in the same way as they do in R1: Gloria evaluates learning based on one way to teach/learn, Steve experiences a gap between his test scores and his self-perception, and he becomes discouraged and confused.

Instead of concluding that he is not OK, as happened in R1, in R2 discouragement and confusion leads to a conclusion that he will rely on his own sense of what is worth learning, how to learn it, and accept the consequences. He increasingly ignores the teacher's directives. As his grades get worse, the teacher interprets this as the inevitable result of not studying what is presented. She is comforted that her single method works for others and that by not following her approach, a student prevents his or her own learning. Gloria views are reinforced by the cycle of events and she rededicates herself to their continued application.





There is another teaching/learning scenario that is being played out in Gloria's classroom. R3 explains the fact that most students learn what is taught using the teacher's methods. These students follows the teacher's instructions and get satisfactory results. They are "good" students to Gloria and reinforce her belief in her methods.

The most important factor in these school experiences is the teacher's belief in one way to teach and learn. This leads different paths for students because there are many different learning styles in nature. This is represented by the bold box outside the loops.

Because the teacher's style does not accommodate many learning styles, individual students will have different experiences gauging the grades they get against their own sense of what they are capable of and what is important for them to learn. Those perceiving a gap and wanting to reduce the inconsistency can conform (R1) or rebel (R2).

Finally, it is noteworthy that all of the loops are reinforcing—a small change builds on itself—and all reinforce the teacher's belief in her one way (R1-3). This set of relationships and methods will endure even though two of the stories portray outcomes discrediting the teacher's methods.

But we know from the beginning that Steve is a good learner. He loves to learn. Is there a system that would foster his learning instead of confront it? R4 illustrates that system. Steve has an

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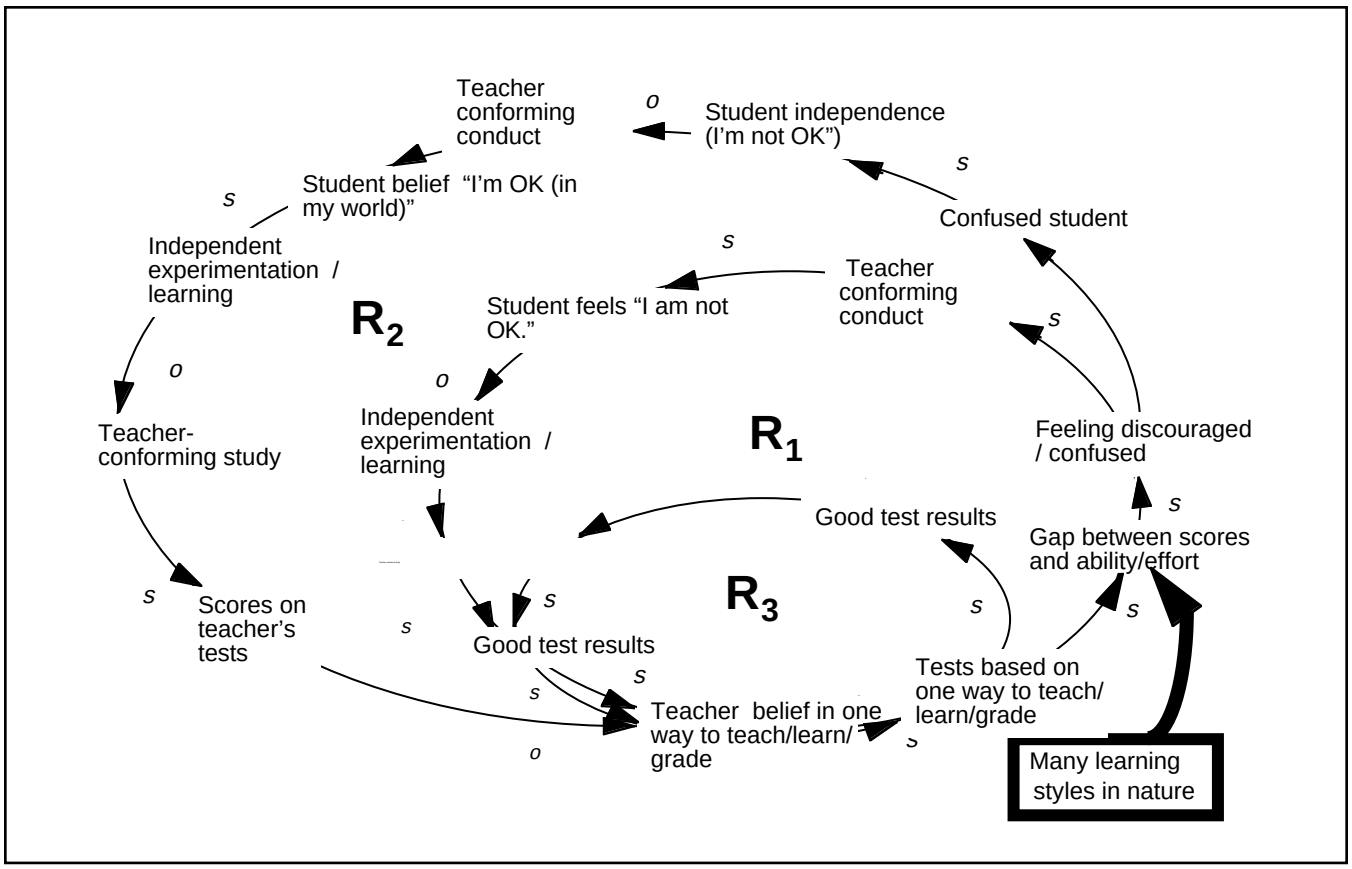
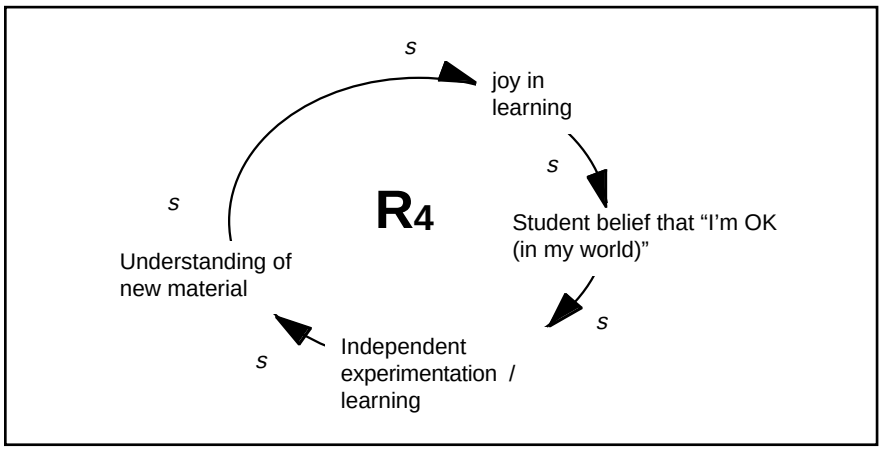


STEVE'S DILEMMA, *continued from page 5*

intrinsic desire to learn. He seeks knowledge through experimentation and questions. These methods net understanding of new material for Steve, which gives him joy in learning. This joy in learning makes Steve feel "OK" in his world, which strengthens his desire to learn. This is the reinforcing loop that Steve lived in before he entered the standard system driven by his teacher's belief in one way to teach and learn.

Steve's dilemma is not uncommon. Who is he to believe? His view and that of his parents who believe that he is bright and capable or that of his teacher who thinks that he is undisciplined and just "satisfactory." The looping diagrams show the structure of reinforcing processes in which every element is both "cause" and "effect." And they help crystallize a question that is central to education: If there are many learning styles in nature, what are we doing to our children by pursuing a singular teaching and learning approach?



When we added R4 to the picture, we get a model that tells us much about how we view and design education systems.

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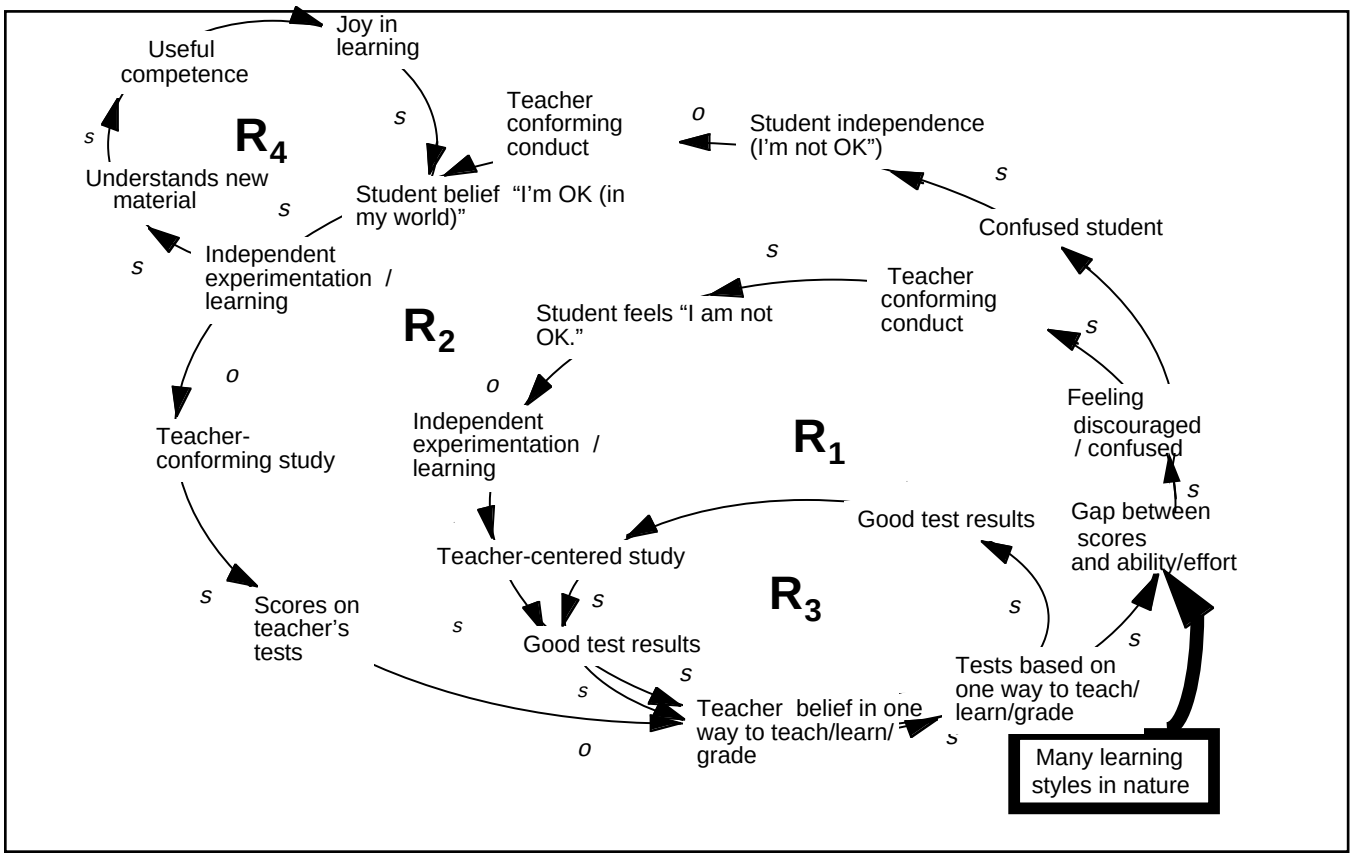
As Joe was pursuing early drafts of these four loops, his 16-year-old son asked what they were. Joe told each story and his son immediately said, "That covers my high school. The main story (R1) is about the kids who are struggling, in special ed., dropouts or those on the way. The second group (R2) are the kids the school district created a special alternative school for to keep them in the school system. The third story (R3) is about those getting by in the typical classes. The fourth (R4) are those in the TAG (Talented and Gifted) courses who are left pretty much alone. Yeah, that's it all right."

DILEMMA *continued on page 10*



THE BLAIR MAGNET PROGRAM OF SLIVER SPRING, MARYLAND

As a program (Blair Magnet Pro gram, grades 9-12), we are currently at the crossroads of getting system dynamics integrated into our content courses. Historically we have introduced system dynamics and STELLA to our freshmen in computer science and have them build physics models in conjunction with their physics course. As juniors and seniors many students elect to take Modeling and Simulation where they further pursue system dynamics. One of their projects is to work with another teacher to develop a model which could then become a teacher tool for that teacher to use with his/her classes including Physics, Chemistry, Earth Science, Social Studies, and English classes.

We have a group of experienced student modelers and a collection of student-developed models. Our next step is to get these models actually integrated into the curriculum of other courses. We want to have the teachers who have served as mentors to our Modeling and Simulation students evaluate these models on many levels from scientific accuracy to pedagogical feasibility and develop and implement lesson plans incorporating the models.

Our biggest problem to date is getting our staff to integrate system dynamics into their curriculum. Teacher workshops have been positively received, but insufficient in length and depth to help teachers become comfortable enough to begin to develop their own models and to use models within their curriculum.

Our biggest success to date is having our students reach out to the teachers by asking the teachers to be their mentors in the development of models that could then be used within the teachers' classes. Given the personal touch of a student-teacher mentorship we hope to generate the teachers' interest and through one-on-one meetings we hope to demystify modeling for the teachers.

We are also closely tied with the Maryland Virtual High School (MVHS) program funded by a grant from NSF. Mary Ellen Verona (mverona@goober.mbhs.edu) is developing and maintaining a platform where teachers and students can collaborate on curriculum development and projects in computational sciences. There are currently teachers and students participating from six different high schools throughout the state of Maryland connected with one another through the internet. System Dynamics figures prominently.

We have two www sites that may be of interest:

http://www.mbhs.edumathsci.html
links to student-developed STELLA models

http://www.mbhs.edu/mvhs.html
MVHS home page with links to current projects

Activities which are on-going include:

Mathematics - Teachers are often intimidated by computers and the mathematics of system dynamics. We have one teacher who uses system dynamics in her Functions and Analysis I (Calculus) courses. Population, predator prey, disease and spring models using Euler's are used for students to analyze the error as the time increments decrease. A variety of environments are explored: MathCad, spreadsheets, and calculators.

Biology - Partial list of existing models: A Model of Ecological Succession from Sand Dune to Maritime Forest in East Coast Islands, Transformation of Glucose into ATP, SAV Populations in the Chesapeake Bay

Chemistry - Partial list of existing models: Modeling the Course of the Haber Process Using STELLA, Oxygen Levels in a River as Related to the Amount of a Given Kind of Waste Dumped into the River, A Model Depicting the Amount of Heat Energy From the Combustion of Octane in Varying Oxygen Environments, A Model of Acid-Base Titration

Earth Science - Partial list of existing models: A Comet's Flight Through the Earth's Atmosphere, The Sun- Earth-Mars System and Retrograde Motion

This information is excerpted from a communication from Lola Piper, a teacher in the Blair Magnet program. It is a program which seems to be rich in the uses of system dynamics in the classroom. It is wonderful to have found out about their program.

EDUCATIONAL LEADERSHIP

The Creative Learning Exchange was mentioned by Peter Senge in an interview with John O'Neil in the April 1995 issue of *Educational Leadership*. In the brief time since its publication, more than 20 inquiries have been received from across the United States. Educators from Honolulu to San Francisco to New York City and from Georgia to Texas to Michigan to Washington have called, e-mailed, and faxed questions and requests for information and materials.

We are delighted by this interest and grateful for the additions to our network, and urge our readers to read Mr. O'Neil's article, entitled *"On Schools as Learning Organizations: A Conversation with Peter Senge."*

UPDATES. . . *continued from page 2*

Systems Education Consortium

A Consortium of the school systems of Concord, Carlisle, Acton, and Harvard, Massachusetts grew out of the Systems Thinking and Dynamics Modeling Conference held last summer. Participants from the districts have met periodically throughout this school year at sessions of mutual interest.

Approximately 25 people joined Don Seville and Laurie Brown from Gould-Kreutzer Associates to start a process of discussion on the subject of scheduling. There were representatives from all the school systems involved in the consortium and active participation in the process was evident.

Don and Laurie used the Hexagon Technique to facilitate discussion. This technique entails writing down comments or strongly held opinions on the subject (scheduling) on magnetic hexagons. After everyone had substantial input, the hexagons were grouped into logical categories. The categories which emerged from the February 9th discussion were:

Pace of Change
Attitudinal Changes
Flexibility
Interaction and Communication
Stress
Curriculum
Parent Concerns
Designing for Students
Concrete Reality
Nuts and Bolts
Ends and Means of Philosophy
A Fresh Look
Daily Design Considerations
Overall Design Considerations.

In the second meeting, these categories were used to further create a framework from the discussion. Gould-Kreutzer and consortium members focused on the actual process of the meetings as well as the question—What behavior change would you see if scheduling were "working" or "better"? The participants came up with a list of variables which later generated a discussion of causality. All the participants were asked to spend a bit of time, preferably with another person, figuring out the causal loops as generated and trying to create a reinforcing loop (every factor is going in the same direction so it spirals up or down) and a balancing loop (there is a factor in the flow which goes in an opposite direction that balances the action).

A summary of the process in the first two meetings:

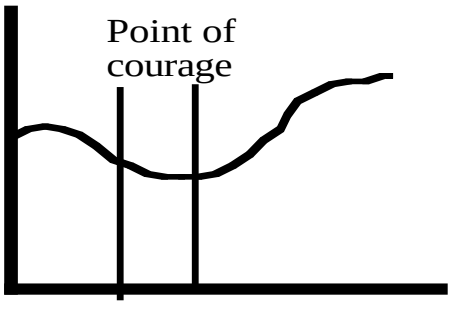
1 Framing question *(Statement of the issue)*
2 Issues to Clusters *(What is the full picture?)*
3 Behavior/Reference Modes *(What is the problem?)*
4 Causal Hypothesis *(Why is the system acting this way?)*
5 Test Hypothesis/Policies *(Simulation Model)*

A list of variables which emerged from the meetings:

Teacher Stress
Student Stress
Number of Incomplete Projects/ Tasks
Appropriate Student Learning
Planning/Reflection Time
Flexibility
Perception of Rigidity in System
Teacher Morale
Collegiality
Teacher Requests for Time
Gap between Values and Reality
Parent Feedback
Use of Sick Days
Level of Student/Teacher Interac tion Outside Classroom
Amount of Cheating/Dishonesty
Number of Successful Students
Student Engagements
External Demands
Communication
Physical Energy Level,
Amount of Change in the World

Consortium members who attended the meeting on April 6th took advantage of the small group and the able guidance of Don Seville and Dave Packard of Gould-Kreutzer to continue to discuss and refine the causal loops which had been proposed by the group at the March 9th meeting. Don set the stage for the meeting by delineating the five C's of systems thinking:

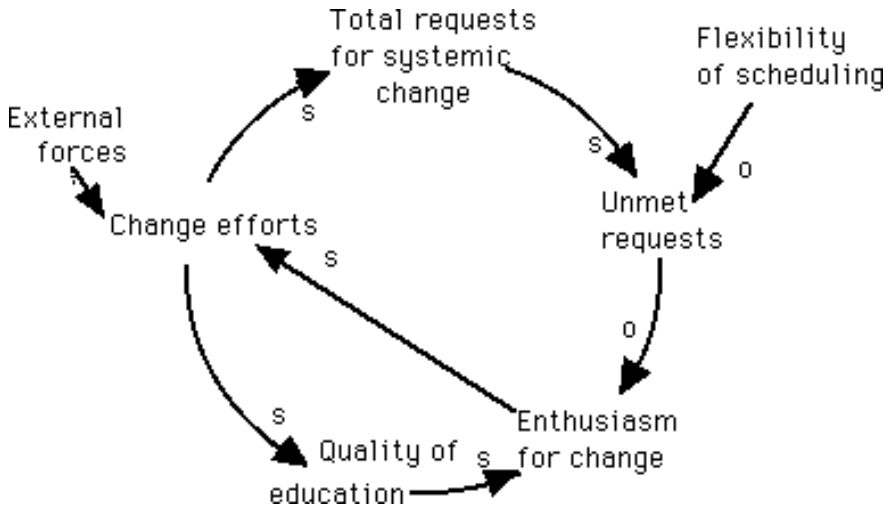
Curiosity—why does this happen?
Clarity—use of tools to gain a clear vision into the problem.
Compassion—knowing that each person has only a partial view and others' views are as valid as our own.
Choices—delineate a spread of lots of little choices.
Courage—the majority of real solutions have one thing in common—things get worse before they get better.



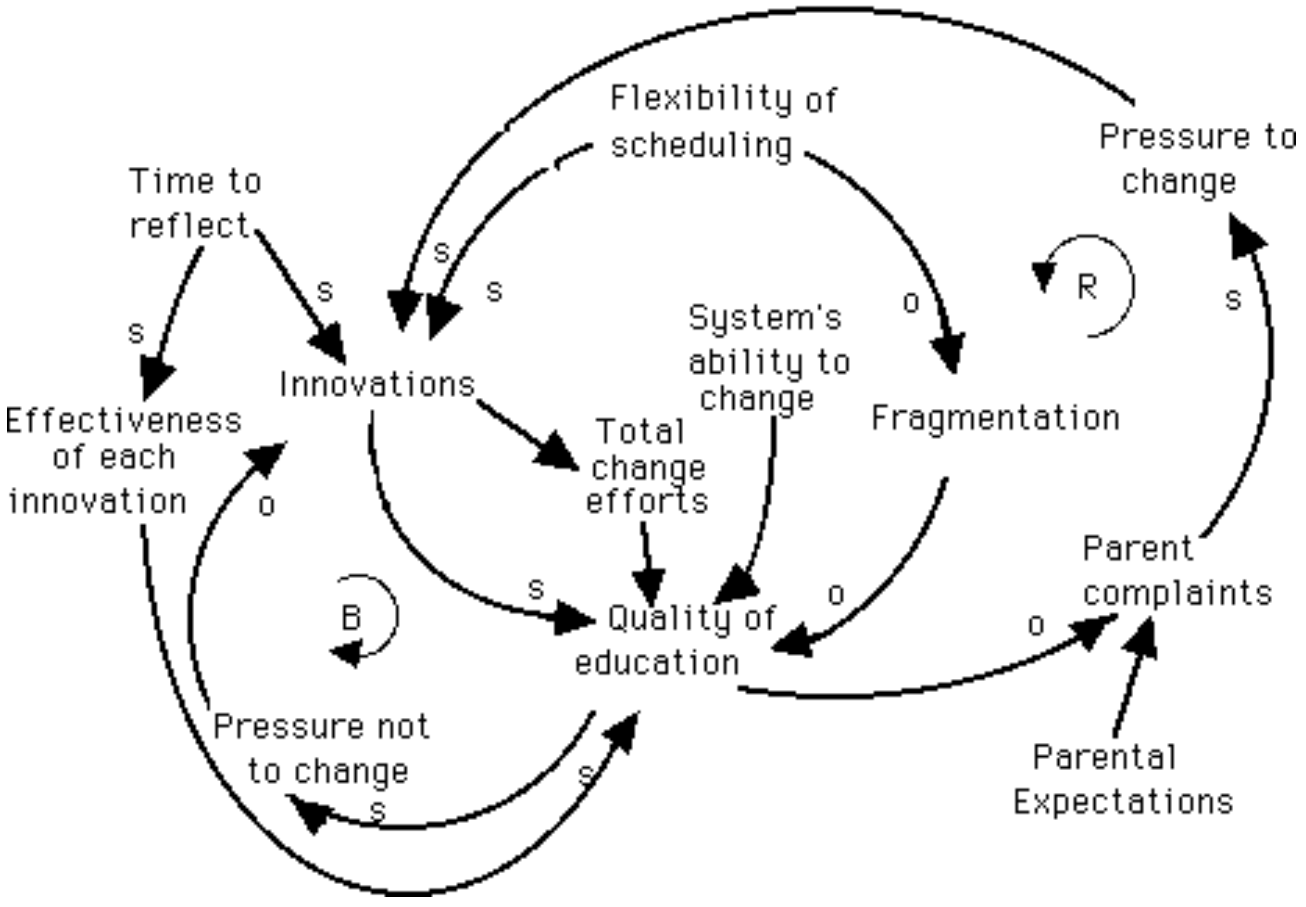
THINGS GET WORSE BEFORE THEY GET BETTER

Systems thinking helps make clear choices and create the ability to communicate with others.

The group came up with the following loops which will provide the basis for a small model. The model will be created for the fourth consortium meeting, which will be held in May.



How Flexibility Could Impact Quality of Education



What Leads Us (Teachers) to Try New Teaching Methods

The Creative Learning Exchange

is pleased to announce
the second

Systems Thinking and Dynamic Modeling Conference

to be held in the greater Boston area
the week preceding the
1996 International System Dynamics Conferrence
Boston, Massachusetts

Tentative dates: July 17,18, 19, 1996

Location: TBA

INTERESTED IN INVESTING?

All of us are interested in promoting the use of systems education in our schools. A number of you have asked if there is a charge for the services of the Creative Learning Exchange, or what you can send to help defray the costs of printing and mailing to you.

The Creative Learning Exchange will continue to send out materials free of charge to all those on the mailing list, regardless of their desire to invest at this time. However, if you would like to invest in our effort here at the Creative Learning Exchange, your contribution would be appreciated. You may donate any amount you wish; perhaps $50 is a reasonable amount for a year. All contributions are tax-deductible.

I am sending _____ to *The Creative Learning Exchange* to help invest in the future of systems education .

Name_____

Address_____

Thank you!!

***The Creative Learning Exchange*, 1 Keefe Road, Acton, MA 01720**

STEVE'S DILEMMA,

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While Joe Jr's observations may not be quite the way it is, they beg an important question: Are alternative approaches to education built on an understanding of different learning styles? Or are they more often built around assumptions about children's level s of motivation and/or perceived level of intelligence?

If different styles of learning are inherent in nature, and if it is "OK" to learn different says, then how should we structure our learning systems?

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