Whole Systems ActionGrams: A Diagramming Tool that Enhances Systemic Inquiry and Action

Ray D. William
Professor and Extension Specialist
Department of Horticulture
Oregon State University
Corvallis, OR 97331

Abstract

Whole systems ActionGrams engage learners in framing complex inquiry by drawing a system, identifying components, drawing relationships, and looking for leverage or possible actions in the system; all within the first 10 minutes of entering a classroom or participating in Extension events. People comment that the exercise helps illustrate interactions while constructing a common context and understanding between participants. Also, leverages become topics to begin inquiry by conceptualizing the whole and its interactions rather than parts or problems to fix. Facts are gathered to validate thinking and potential decisions framed within the context of dynamic systems that function or change over time. The technique is quick, easy, adaptable, systemic, and action-oriented with participants engaged in learning.

Introduction

As you enter a classroom or extension event, an educator invites you to draw a river, identify resources or components along the river, draw relationships between the resources, and look for leverage in the system; all within 10 minutes! Nervous laughter and a bit of joking increases the sense of urgency, but to follow instructions, a squiggle representing a river is drawn on flip-chart paper. Soon, others begin to draw components, relationships, and leverage when someone wonders, "what does leverage mean?" An instructor explains, "leverage is defined as the point(s) in a system where greatest impact, either positive or negative, is expected" (Senge et al., 1994).

Time's up! Groups are asked to describe only the leverages since everyone can see the ActionGrams. Ideas are expressed quickly. People comment about possible actions, insights, and interactions while others listen and fidget from foot to foot. Leverages are recorded on a composite sheet for subsequent discussion by all attendees. Participants note that learning began before instructors introduced the issue or course syllabus.

This paper describes a simple, yet adaptable pedagogical technique designed to engage in systemic learning and action as people grapple with complex issues and topics at the dawn of the 21st century. The technique is introduced as you begin reading the paper since this is exactly how students and citizens experience this approach to systemic inquiry. ActionGrams frame inquiry within the science of systems thinking and practice combined with research involving learning rather than teaching. Successes describe examples of context and opportunities where the technique encourages participatory inquiry and systemic actions.

Methods of Framing Systemic Inquiry and Action within Complex Topics

Methods of framing complex systems, while encouraging critical evaluation of alternatives within the context of systemic or functional systems, requires considerable teaching effort for citizens and students to grasp and use. Faculty have tried mind maps (Buzan, 1989), archetypes (Senge et al., 1994), loop diagrams (Anderson and Johnson, 1997; Bella, 1997), flow diagrams (Hyerle, 1996), and systems maps or rich pictures (Checkland, 1981) described briefly in Table 1. ActionGrams, however, were designed by listening to people and how they deal with complex issues. The method is quick and easy,

Table 1. Diagraming techniques used by students and citizens grappling with natural resource issues to enhance understanding and ability to grasp and manage complex, adaptive systems.

Diagramming technique	Description and intended use	Reference
Mind maps	Circle key nouns while listening for multiple connections linked with verbs on lines. Themes developed for beginning issues.	Buzan, 1989
Archtypes	Archetypes show similar patterns or behaviors such as "tragedy of the commons," shifting the burden, or "success to the successful," etc., with systemic delays and common leverages.	Senge, et al., 1994
Loop diagrams	Factors or behaviors describe a story with reasons (incoming arrow) and consequences (outgoing arrow) that loop to form circles or systems rather than lines or chains of causality.	Anderson and Johnson, 1990; Bella, 1997
Flow diagram	Movement or flow of materials, actions, and events are diagrammed with multiple connections from source to consequence or product.	Hyerle, 1996
Rich pictures	Stories are depicted in relationships with arrows showing direction, factors in loops, emotions in cartoon drawings, etc. Checkland also draws systems as complex inquiry with multiple views and consequences.	Checkland, 1981

Whole Systems ActionGrams: A Diagramming Tool that Enhances Systemic Inquiry and Action

Ray D. William
Professor and Extension Specialist
Department of Horticulture
Oregon State University
Corvallis, OR 97331

Abstract

Whole systems ActionGrams engage learners in framing complex inquiry by drawing a system, identifying components, drawing relationships, and looking for leverage or possible actions in the system; all within the first 10 minutes of entering a classroom or participating in Extension events. People comment that the exercise helps illustrate interactions while constructing a common context and understanding between participants. Also, leverages become topics to begin inquiry by conceptualizing the whole and its interactions rather than parts or problems to fix. Facts are gathered to validate thinking and potential decisions framed within the context of dynamic systems that function or change over time. The technique is quick, easy, adaptable, systemic, and action-oriented with participants engaged in learning.

Introduction

As you enter a classroom or extension event, an educator invites you to draw a river, identify resources or components along the river, draw relationships between the resources, and look for leverage in the system; all within 10 minutes! Nervous laughter and a bit of joking increases the sense of urgency, but to follow instructions, a squiggle representing a river is drawn on flip-chart paper. Soon, others begin to draw components, relationships, and leverage when someone wonders, "what does leverage mean?" An instructor explains, "leverage is defined as the point(s) in a system where greatest impact, either positive or negative, is expected" (Senge et al., 1994).

Time's up! Groups are asked to describe only the leverages since everyone can see the ActionGrams. Ideas are expressed quickly. People comment about possible actions, insights, and interactions while others listen and fidget from foot to foot. Leverages are recorded on a composite sheet for subsequent discussion by all attendees. Participants note that learning began before instructors introduced the issue or course syllabus.

This paper describes a simple, yet adaptable pedagogical technique designed to engage in systemic learning and action as people grapple with complex issues and topics at the dawn of the 21st century. The technique is introduced as you begin reading the paper since this is exactly how students and citizens experience this approach to systemic inquiry. ActionGrams frame inquiry within the science of systems thinking and practice combined with research involving learning rather than teaching. Successes describe examples of context and opportunities where the technique encourages participatory inquiry and systemic actions.

Methods of Framing Systemic Inquiry and Action within Complex Topics

Methods of framing complex systems, while encouraging critical evaluation of alternatives within the context of systemic or functional systems, requires considerable teaching effort for citizens and students to grasp and use. Faculty have tried mind maps (Buzan, 1989), archetypes (Senge et al., 1994), loop diagrams (Anderson and Johnson, 1997; Bella, 1997), flow diagrams (Hyerle, 1996), and systems maps or rich pictures (Checkland, 1981) described briefly in Table 1. ActionGrams, however, were designed by listening to people and how they deal with complex issues. The method is quick and easy,

Table 1. Diagraming techniques used by students and citizens grappling with natural resource issues to enhance understanding and ability to grasp and manage complex, adaptive systems.

Diagramming technique	Description and intended use	Reference
Mind maps	Circle key nouns while listening for multiple connections linked with verbs on lines. Themes developed for beginning issues.	Buzan, 1989
Archtypes	Archetypes show similar patterns or behaviors such as "tragedy of the commons," shifting the burden, or "success to the successful," etc., with systemic delays and common leverages.	Senge, et al., 1994
Loop diagrams	Factors or behaviors describe a story with reasons (incoming arrow) and consequences (outgoing arrow) that loop to form circles or systems rather than lines or chains of causality.	Anderson and Johnson, 1990; Bella, 1997
Flow diagram	Movement or flow of materials, actions, and events are diagrammed with multiple connections from source to consequence or product.	Hyerle, 1996
Rich pictures	Stories are depicted in relationships with arrows showing direction, factors in loops, emotions in cartoon drawings, etc. Checkland also draws systems as complex inquiry with multiple views and consequences.	Checkland, 1981

requires minimal cognitive energy to learn, and leads inquiry toward decisions or additional cycles of learning. The following instructions are placed on the wall as participants enter the classroom or Extension event.

ActionGram Instructions

1. Draw a system
2. Identify factors or components of the system
3. Draw relationships between components or factors, and
4. Look for leverage in the system, all in 10 minutes!

ActionGrams are meant to frame inquiry or learning within a systemic context of whole systems while postponing momentarily the need to "fix" parts (Ackoff, 1999) or judge comments by other participants. Learning, laughing, and joking about artistry skills improves the conversation among people who may share conflicting views. Keeping the diagram visually in front of people helps them discover relationships and interactions within functional systems before validating with facts or data. Asking people to identify leverages, or places in a system where greatest impacts might be expected, fosters consideration of possible actions or systemic improvements. Participants begin to frame their own inquiry and questions (Novak and Gowin, 1984; Brooks and Brooks, 1999) while considering perspectives, personal values, and divergent thinking. Issues and topics for additional inquiry emerge within the framework of a functional system that includes feedback loops with either spatial (including hierarchy) or temporal qualities, or both.

Successes

Undergraduate and graduate students, citizen groups, people attending conferences, and university faculty have used ActionGrams to frame food and agricultural systems, watersheds, and numerous other systems topics. Specific instructions vary depending on purpose or educational objective. Imagine framing a topic of personal interest or concern as you consider the following groups of people and examples.

Undergraduate classes

Each year, students enrolled in a Natural Resource Issues or the Systems Thinking & Practice class are asked to complete the ActionGram as they enter the classroom. Learning tension appears on their faces, but they draw farm, health, business, engineering, river, ecosystem, parking and many other systems before explaining the syllabus, introducing faculty, or describing course expectations. As students describe leverage, faculty elaborate principles of whole systems inquiry such as feedback, hierarchy, emergence, or temporal behavior of the system. Students often say, "Oh yeah, my mind zooms, loops, and imagines multiple consequences" or "We know that wiggling one part wiggles other parts of the system." Nearly every student begins to recognize that this class emphasizes experiential learning (Kolb, 1984). The diagram introduces systems thinking while providing an example of possible visuals and relational thinking tools designed to frame whole systems inquiry for students (King et al., 1999; William, 2000).

Graduate discussions

The first ActionGram was tested with fish and wildlife graduate students while they explored "human dimensions" or the social aspects of their science. My topic was systems thinking, but it was mid-afternoon on a warm Saturday following a whole day of speakers! I wondered how the ActionGram might work. Would students wake up and participate? The first group drew small figures with arrows and no words. A second group wrote words with arrows representing connections. A woman exclaimed, "Oh, our thinking is through the eyes of a fish!" A geography professor in the third group fussed until participants defined their purpose of "enhancing fish habitat" followed by a drawing. As each group presented their ideas about leverage, biases and mental models were explored while pondering what farmers or other natural resource managers and scientists might think about the assumptions inherent in these diagrams. The technique achieved both the purpose of exploring "human dimensions" and awakening student interests in active learning and systems thinking.

Citizen groups

With the success generated among students on campus, people in agriculture and counties were introduced to ActionGrams. Cowboys with big hats and authentic boots entered a warm room with a pot-bellied stove one evening following the first nice day in spring to discuss water issues. Following a brief business meeting, groups of 5 completed a "river diagram" with ample joking about artistic skills. After 15-minutes, one group shared their leverage as drawings while another listed words separated in two columns by a squiggle (river); a couple other groups had combinations or words, pictures, and relationships. Ambling toward their diagram (Figure 1), a man explained that, "Every river has two sides and so does every issue". He returned to his chair as silence and thoughtful reflection punctuated the moment.

In a series of meetings along the Klamath river, the ActionGram improved communication between groups of fishers, Native Americans, recreational guides, and ranchers who shared common concerns

requires minimal cognitive energy to learn, and leads inquiry toward decisions or additional cycles of learning. The following instructions are placed on the wall as participants enter the classroom or Extension event.

ActionGram Instructions

1. Draw a system
2. Identify factors or components of the system
3. Draw relationships between components or factors, and
4. Look for leverage in the system, all in 10 minutes!

ActionGrams are meant to frame inquiry or learning within a systemic context of whole systems while postponing momentarily the need to "fix" parts (Ackoff, 1999) or judge comments by other participants. Learning, laughing, and joking about artistry skills improves the conversation among people who may share conflicting views. Keeping the diagram visually in front of people helps them discover relationships and interactions within functional systems before validating with facts or data. Asking people to identify leverages, or places in a system where greatest impacts might be expected, fosters consideration of possible actions or systemic improvements. Participants begin to frame their own inquiry and questions (Novak and Gowin, 1984; Brooks and Brooks, 1999) while considering perspectives, personal values, and divergent thinking. Issues and topics for additional inquiry emerge within the framework of a functional system that includes feedback loops with either spatial (including hierarchy) or temporal qualities, or both.

Successes

Undergraduate and graduate students, citizen groups, people attending conferences, and university faculty have used ActionGrams to frame food and agricultural systems, watersheds, and numerous other systems topics. Specific instructions vary depending on purpose or educational objective. Imagine framing a topic of personal interest or concern as you consider the following groups of people and examples.

Undergraduate classes

Each year, students enrolled in a Natural Resource Issues or the Systems Thinking & Practice class are asked to complete the ActionGram as they enter the classroom. Learning tension appears on their faces, but they draw farm, health, business, engineering, river, ecosystem, parking and many other systems before explaining the syllabus, introducing faculty, or describing course expectations. As students describe leverage, faculty elaborate principles of whole systems inquiry such as feedback, hierarchy, emergence, or temporal behavior of the system. Students often say, "Oh yeah, my mind zooms, loops, and imagines multiple consequences" or "We know that wiggling one part wiggles other parts of the system." Nearly every student begins to recognize that this class emphasizes experiential learning (Kolb, 1984). The diagram introduces systems thinking while providing an example of possible visuals and relational thinking tools designed to frame whole systems inquiry for students (King et al., 1999; William, 2000).

Graduate discussions

The first ActionGram was tested with fish and wildlife graduate students while they explored "human dimensions" or the social aspects of their science. My topic was systems thinking, but it was mid-afternoon on a warm Saturday following a whole day of speakers! I wondered how the ActionGram might work. Would students wake up and participate? The first group drew small figures with arrows and no words. A second group wrote words with arrows representing connections. A woman exclaimed, "Oh, our thinking is through the eyes of a fish!" A geography professor in the third group fussed until participants defined their purpose of "enhancing fish habitat" followed by a drawing. As each group presented their ideas about leverage, biases and mental models were explored while pondering what farmers or other natural resource managers and scientists might think about the assumptions inherent in these diagrams. The technique achieved both the purpose of exploring "human dimensions" and awakening student interests in active learning and systems thinking.

Citizen groups

With the success generated among students on campus, people in agriculture and counties were introduced to ActionGrams. Cowboys with big hats and authentic boots entered a warm room with a pot-bellied stove one evening following the first nice day in spring to discuss water issues. Following a brief business meeting, groups of 5 completed a "river diagram" with ample joking about artistic skills. After 15-minutes, one group shared their leverage as drawings while another listed words separated in two columns by a squiggle (river); a couple other groups had combinations or words, pictures, and relationships. Ambling toward their diagram (Figure 1), a man explained that, "Every river has two sides and so does every issue". He returned to his chair as silence and thoughtful reflection punctuated the moment.

In a series of meetings along the Klamath river, the ActionGram improved communication between groups of fishers, Native Americans, recreational guides, and ranchers who shared common concerns

and visions about water. Comments from ActionGrams contrasted sharply with the finger-pointing and "blame game" that resulted from previous sessions when mind maps identified issues and themes for continued inquiry. Participants began with relationships and ideas for improvement while acknowledging people at the other end of the watershed. Actions continued in some groups beyond this series of meetings.

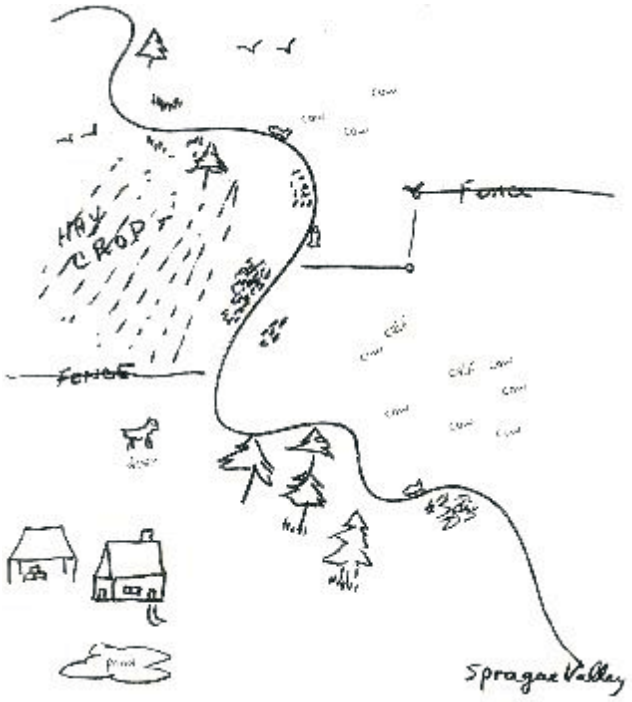

Figure 1. River Diagram

Citizens named to a Task Force by the Governor struggled with a controversy about remodeling or removing a dam from a river. At issue was "fish passage" and survival through or around seven sites across the face of the dam including ladders, a turbine, irrigation canals, and high water overflows. A diagram representing the 7 sites as a system was drawn to focus initial discussion, data acquisition, and eventual decisions within a dynamic framework of fish passage throughout the year. To place the dam in context with the river and ocean, another diagram represented factors such as predators, human activities along the river and ocean, and natural barriers including low water during summer. A technique developed by Lev, et al, 1995, uses dots to indicate change (delta) over time (DOTs). Members (18) each placed 10 DOTs on those factors that represented their concerns or perspectives associated with fish passage and survival. Half (46%) of the DOTs were placed in the ocean, yet members commented that all of the discussion occurs along rivers where agencies attempt to control actions. Task Force members hypothesized that the salmon problem will continue until we explore the whole system!

Conference attendees

Keynote speakers often frame conference topics and the agenda while attendees listen. Recording the narrative and its complexity using the principles of ActionGrams provides a relational diagram as a reference for attendees or for active discussions in subsequent events or poster sessions. Attendees of an interdisciplinary Farming Systems Research & Extension conference drew ActionGrams as a way to conceptualize agricultural, community, regulatory, and social systems followed by a conference agenda that explored both the relationships and disciplinary detail within the framework of whole systems. Drawing ActionGrams encouraged attendees to practice and explore the merits of discovering relationships, leverage, and systemic learning. In contrast, faculty and agency professionals balked at drawing the ActionGram during a poster session, perhaps because they were only interested in extracting information.

Interdisciplinary faculty and administrators

Faculty exploring sustainable agriculture curriculums, programs, or agroecology research at three universities quickly drew food and ag systems during consulting workshops. University administrators drew a food and natural resource system in 3 minutes as a technique to introduce them to both the format and content of a natural resource systems conference planned with four themes and interactive learning. This active learning technique encouraged administrators to consider who should be encouraged to attend and minimized time consumed in explanations and clarification of detail. In each event, faculty expecting to deal with complex systems created diagrams with ease while a few grumble about participatory activities and express preferences of lectures and synthesized information from experts. Other faculty worry about losing control of the learning process or documenting that learning has occurred.

Conclusion and Summary

ActionGrams contribute naturally to whole systems inquiry in fun, quick, and relational ways that focus decisions toward systemic thinking and actions while providing a framework for integrating facts and relevant information to validate the system. The technique contributes to synthesis or divergent thinking before analysis and fact finding. Drawing and keeping systemic diagrams in front of inquirers encourages focused learning within the context of the whole. People express enthusiasm for this simple, flexible learning and thinking technique.

Literature Cited

Ackoff, R.L. 1999. Re-creating the corporation: A design of organizations for the 21st century. Oxford Univ. Press, Inc., NY.

Anderson, V. and L. Johnson. 1997. Systems thinking basics: From concepts to causal loops. Pegasus Press, Cambridge, MA.

Bella, D.A. 1997. Organized complexity in human affairs: The tobacco industry. J. Business Ethics. 16:977-999.

Brooks, J.G. and M.G. Brooks. 1999. In search of understanding: the case for constructivist classrooms. Assoc. Supervision and Curriculum Development. Alexandria VA.

Buzan, T. 1989. Use both sides of your brain. Plume, New York, NY.

Checkland, P. 1981. Systems thinking: Systems practice. J. Wiley & Sons, NY.

Hyerle, D. 1996. Visual tools for constructing knowledge. Assoc. Supervision and Curriculum Development. Alexandria VA.

King, J., J. Peters, and R.D. William. 1999. Whole systems thinking and practice. Infrastructure: Sustaining Systems. http://notes3.nums.unt.edu/infrstrt.nsf

Kolb, D. 1984. Experiential learning: Experience as the source of learning and development. Prentice Hall, NJ.

Lev, L.S., F. Smith, and R.D. William. 1995. DOTS: A visual assessment technique for groups. Electronic J. of Extension. 33(5):3pgs.

Novak, J. and B. Gowin. 1984. Learning how to Learn. Cambridge Univ. Press, Cambridge.

Senge, P.M., C. Roberts, R.B. Ross, B.J. Smith, and A. Kleiner. 1994. The Fifth Discipline Fieldbook. Doubleday Dell Pub., NY.

William, R.D. 2000. Whole systems inquiry: Watersheds as integral systems for systemic learning and action. In: Cerf, M., D. Gibbon, B. Hubert, R. Ison, J. Jiggins, M. Paine, J. Proost, and N. Roling (eds.). Cow up a Tree: Knowing and Learning for Change in Agriculture. INRA Editions, Versailles Cedex, France.