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The New Hire: Teaching Behavioral Dynamics in Management

Paul L. Stepanovich and Pamela J. Hopkins
Southern Connecticut State University
Department of Management and MIS
501 Crescent Street
New Haven, CT 06515
(203) 392-6549
stepanovicp1@southernct.edu, hopkinsp1@southernct.edu

Abstract

System dynamics is conspicuous by its absence in the major management education journals. At the same time, there are calls for better handling of complexity and new theory generation; areas where system dynamics can make a major contribution. This paper presents a simulation within a learning environment aimed at reinforcing organizational behavior concepts, especially emphasizing the interconnectedness of these concepts. While the intent is not to teach system dynamics, the simulation provides an opportunity to introduce system concepts. This paper concludes by suggesting a strategy for entry into the management education journals involving a longitudinal quasi-experimental design to evaluate alternative techniques.

Introduction

Business students, especially those in management, are presented with many theories of the behavioral aspects of managing an organization. These topics typically include perception, motivation, stress, group dynamics, and leadership. However, much of the literature in management education is devoid of the term "system dynamics". For example, no articles were found relating to system dynamics in either the *Journal of Management Education* or the new *Academy of Management Learning and Education* journal. A few years ago, one of the authors submitted a flight simulator exercise to the *Journal of Management Education*. It was not sent out for review since it was felt that the readership would not be interested in flight simulators.

Interestingly, at about the same time in this journal, the editor, in a series of editorials, had called for a reorientation of management education to address the changing nature of organizations, specifically mentioning the ability of managers to deal with the increasing complexity found in today's organizations (Bilimoria 2000). Two years earlier the same editor had called for better, newer, and more relevant theories of organizational behavior (Bilimoria 1998). The irony is striking since system dynamics is undoubtedly one of the most powerful tools for dealing with complexity and is, at the same time, a powerful tool for theory generation. And yet system dynamics is conspicuous by its absence in key management education journals.

We see these calls for handling complexity and generating theory as an opportunity for system dynamics. In a recent article, Repenning (2003) describes the difficulty that system dynamics has had in breaking into other fields, specifically mentioning organizational theory. He provides cogent advice for those attempting to do so and reiterates its importance to the field of system dynamics. In the same article, he refers to the central role of management education:

> Management education defines and sustains many, if not most, of the rules of the game in modern business. Consequently, there are few institutions that offer a better platform for changing the way managers think and act. Without a strong hold in this process, system dynamics will continue to face an uphill battle. (323)

The purpose of this article is to begin to explore an entry into management education through the behavioral topics in organizational behavior.

Our objective here is to present a system dynamics model (management flight simulator) and learning environment – at a very introductory level – aimed at integrating several of the concepts covered in a typical organizational behavior course. The intent is not to teach students system dynamics explicitly. However, by the nature of the medium and the model content, the students will be exposed to system concepts.

We anticipate two barriers to gaining entry to management education. The first deals with the readiness of traditional students to respond to systems thinking. The second deals with the readiness of the field of management education. A brief review of these areas is presented first in the review of the literature. The content of the model and a process for its presentation is then presented followed by a discussion of the link to organizational behavior.

Review of the Literature

Adult Learning Theory

Traditional college students come to the classroom with different levels of thinking patterns (Perry 1970). Those students at the lower levels of thinking see the professor as an authority and all knowing whereas at the higher levels of thinking, the student relates knowledge to each context. The professor's role is seen as a guide to learning.

Similarly, Kegan (1994) sees thinking as an evolving process that is moved along by the kinds of experiences we have; for him they are levels of consciousness. For example, most traditional college students would be at Kegan's cross-categorical level where they can think abstractly, can orient to human relationships, and are willing to subordinate their own interests to those of the community. While they are able to adapt to values, they cannot deal with conflicting values – they cannot rise above the relationship to see the relationships of relationships. This requires Kegan's next level, system/complex. Systems thinking requires this level of consciousness. Unfortunately, according to his research, only about half of highly educated professionals and 20% of the general population are at this stage of development (Kegan 1994 195). In fact, his view is that it is not until the masters level that students are expected to reach the system/complex stage of consciousness.

Thus, Kegan would suggest that it may be difficult to get traditional students to systems thinking; it requires a level of consciousness that cannot be "taught". This has some support from Sterman (1989) and Deihl and Sterman (1995) where they document the inability of many students – even advanced engineering students – to think through the dynamics of relatively simple systems.

On the other hand, other sources suggest that it is certainly possible to get students to systems thinking: Senge (1990 Chs. 17, 20) suggests that systems thinking can be developed, the Waters Foundation's efforts in K-12 education, and the MIT System Dynamics in Education Project.

Management Education

Lane (1995) provides a good background on simulation and games noting that business simulation games have a long history but with the criticism that "simulation building is better than playing" (609). There is an extensive literature on flight simulators or microworlds (for examples see Sterman 2000 34, Senge 1990, Winch and Arthur 2002, Alessi 2000). Warren and

Langley (1999) provide a background on system dynamics in management education and propose an entry through strategic management. They advise to keep models simple and transparent and to emphasize task-structure feedback in addition to outcome feedback.

Simulations, although not necessarily computer simulations, are not new to behavioral management education. Litterer (1962) gives a paper and pencil simulation of sales and production, but with an interest in participant satisfaction. Samples of the more recent behavioral simulations include the ethics of capitalism (Collins 1999), an international exchange game involving trust, cooperation, and interdependence (McDonald 2001), power relationships (Kern 2000), flat versus tall leadership models (Meisel 1999), empowerment (Eylon and Herman 1999), and cultural sensitivity (Sullivan and Duplage 1997). None, however, use flight simulators.

Although system dynamics has been largely absent from the management education literature, systems thinking has not. There have been two articles, both in the *Journal of Management Education*, calling for the need to incorporate systems thinking into management education, specifically organizational behavior. Thurston (2000) proposed an approach to develop an appreciation for interconnectedness in student learning. She was specifically interested in attentional strategies, conceptual learning, and the resulting student's mental model. Dent (2001) uses Seinfeld shows in the classroom to demonstrate interconnectedness. In addition to these articles, Nadkarni (2003) investigates mental models and Smith (2003) critical thinking. Thus, there appears to be an opportunity for system dynamics. Our job is to demonstrate how the application of educator-developed models for use in the classroom can be an effective tool for introducing the behavioral theories of management as well as introducing system thinking concepts.

The New Hire Simulation

Before presenting the model, we need to stress that it is in no way intended as an approximation to anything "real". The behavior pattern is hypothetical. The model is crude, simple, and flawed. But this is intentional. Most mental models are crude, simple, and flawed (see Sterman 2000 28). Part of what participants should take from this simulation is the need to acknowledge the limitations of mental models and to think about how to improve them.

Also, as an introductory model meant to expose new managers to very basic behavioral concepts, the model will violate many of the principles of model building. For example, there is the problem of "soft" variables (Coyle 2000). Also, there is no attempt to validate the model. Nor does the model demonstrate "nonlinear" surprises or counter-intuitive behavior caused by interactions rather than the assumptions. The effects are mostly additive.

Background of the Simulation

The student-player of the simulation is given the following charge: You are a new manager and new to this company. Your boss, an executive in operations, explains that the company has had trouble in the past keeping high potential new hires—their performance starts out fine but soon drops off and they leave the company. She also explains that one such new hire has just come on board and will report to you. She expects you to not only keep the new hire but also see that their performance improves over time, especially in productivity, quality and error rates. In fact, this expectation is part of your objectives to be covered in your performance evaluation. With the responsibility comes some authority, however. You control the new hire's workload, determine the amount of oversight that is needed, and develop the new hire by

selecting from a list of development programs.

Inputs and Outputs

The first input controls the degree of workload and autonomy granted to the new hire. It is the amount of the employee's time that is controlled by the manager (between 80 and 120). If set at 80, the manager is granting a fair amount of lee-way to the new hire regarding what their work. This could be both in the projects selected or in the approach to assigned projects. Any value over 100 indicates not only no autonomy but also an excessive workload, requiring hours outside of work to complete.

The second input represents, essentially, the degree to which the player-manager looks over the new hire's shoulder – monitors and responds to his performance. It is scaled between zero and thirty, where zero means little or no monitoring and response. A value of 30 indicates that the new hire is watched closely and feedback is given as appropriate.

The third input consists of eight possible programs that the manager could establish for the new hire. Although the manager can select any combination of the eight, the programs are grouped under "Traditional" or "Non-traditional" programs (Table 1). The traditional programs include pay-for-performance, goal setting, recognition programs, and performance reviews. The non-traditional options are control charts, system redesign, system dynamics, and sub-optimization. The player can select up to four programs in any combination or may choose to implement none of the options. While cost is not explicitly stated as an objective in the background, a cost for each program is listed. Since the traditional programs are existing and on-going, they cost little or nothing to implement. However, the non-traditional programs would require additional resources.

There are six outputs for the player to monitor during the simulation: productivity, quality, errors, sick days, stress, and caring (Table 2). Most are commonly understood. There are two measures of quality, however. "Quality" represents the perception, by internal customers, of the positive aspects of the employee's work. "Errors", on the other hand, reflects the negative aspect. "Caring" reflects a complex construct involving several crucial aspects of behavior, including trust, respect, and commitment.

The Model

As indicated earlier, the model is intentionally simple (Figure 1). It is not intended to teach systems thinking and therefore does not include some of the common delay and feedback options that confound thinking. It simply and directly represents relationships based on assumptions regarding individual performance. The relationships specified represent one possible view of the effects of the interactions among the input variables.

The model contains a mix of expected and unexpected relationships. For example, workload affects both stress and quality in ways that might be expected, that is, high levels of workload will increase stress and decrease quality. However, in this model, in both cases the effects are moderated by caring. Caring plays a central role in the model, indirectly affecting productivity and directly affecting stress, errors and quality. Given a high level of caring, an increased workload would not increase stress levels or decrease quality.

Table 1 Optional Investment Opportunities in New Hire Development Programs

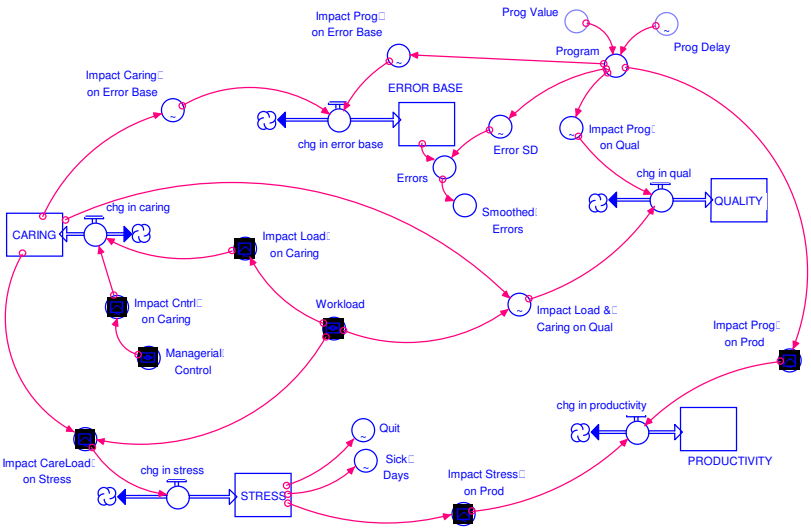
Traditional Programs	
1	Pay-for-Performance: Develop a program to link the employee's pay to his or her performance, typically through a bonus structure. Approximate cost $3,000.
2	Individual Goals: Working with the individual, set "stretch" goals for the individual. No cost.
3	Recognition Program: Develop awards, plaques, "employee-of-the-month" programs to recognize above average performers. No cost to department.
4	Semiannual Performance Reviews: Establish a formal setting where you can review an employee's goals and objectives, discuss performance against those goals, and provide an evaluation of the employee for their file. No cost.
Non-traditional Programs	
5	Control Charts: Develop a control charting mechanism to allow the employee to monitor and evaluate their performance. Approximate cost $5,000.
6	System Redesign: Train employees in systems thinking and idealized design. Approximate cost $10,000.
7	System Dynamics: Train employees in system dynamics modeling to improve understanding and to aid in the development of alternative structures. Approximate cost $10,000.
8	Sub-optimization: Train employees to be aware that part or sub-system optimization can be detrimental to the whole. Approximate cost $5,000.

Table 2 Outputs of the Model

Output	Description
Productivity	Number of projects completed over a period of time
Quality	Positive measurement of quality as a perception of internal customers
Errors	Number of errors found in the new hire's work
Sick Days	Number of sick days taken per month
Stress	A measure of negative stress, net of the individual's ability to cope with stress
Caring	Combines several aspects of work including respect, trust, and interest in work

Note: The outputs, except for sick days, are scaled from 50 to 100 with an initial setting of 100. Sick days range from zero to four per month.

Figure 1 The New Hire Simulation



Unexpected relationships are mostly found between the selection of development programs and the effects on outcomes. For example, if students chose from among the traditional programs errors increase and both productivity and quality decrease over time. The parts of the model and the interrelationships will be challenged and explored further in the discussion section below.

The Control Panel

Figure 2 presents the flight simulator control panel. The left hand side allows the player to adjust the input values and they can observe the effects on the right hand side. The principal outcomes of productivity, quality and errors are presented on the graph, while sick days, stress and caring are presented as warning devices. In addition to this feedback, there are pop up messages that indicate that the new hire 1) is unhappy, 2) is looking for another job, and 3) has resigned.

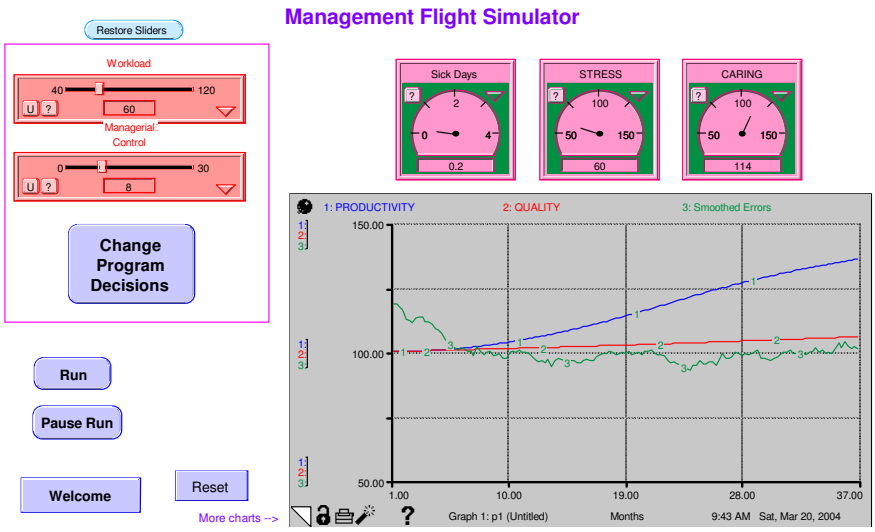
The Learning Environment and Process

We believe that this simulation exercise would be run after the students have covered each of the behavioral aspects of management separately to increase the likelihood of connecting ideas. The exercise would be introduced as a method for integrating concepts.

Room Set-up

To facilitate the development of knowledge and skills, it is necessary to create environments conducive to learning. This includes management of equipment, climate, technology, and groups. For this exercise, the ideal is to have five to seven students randomly assigned to a group with a maximum of four groups. This size allows for optimum participation by group members and allows optimal interaction with the professor (Vennix 1996). In addition, each student would have access to a computer with the New Hire flight simulation. Materials to be distributed would be a written overview of the flight simulation and worksheets which include graphs. In addition, each group is seated at a round table with a flip-chart and markers.

Figure 2 The New Hire Flight Simulator Screen



First Step

Before running the New Hire simulation, students are introduced to the objectives and processes of the simulation. This orientation to the overall session is essential to alleviate learning anxieties of the participants.

The student learning objectives are 1) take the role of the manager; 2) identify assumptions about employee behavior; 3) examine the outcomes to decisions; 4) create predictions about behaviors; 5) challenge assumptions about behaviors and outcomes; 6) define criteria of successful behaviors and outcomes; and finally 7) modify decisions to affect outcomes. By discussing the objectives, students have an expectation of the learning process.

Individual Action (10 minutes)

Each student is asked to select and record the initial settings for workload and managerial control. In addition, the student selects between zero and four development programs (see Table 1). Next, each student is asked to make predictions as to the effect of their decisions on productivity, quality and errors (Table 2). The predictions are over time. On the blank graphs, students record the appropriate ranges for time (36 months) and the three outcomes. At the bottom of each graph students write out the reasoning behind their predictions. This exercise allows each student to deliberate and define their assumptions (Sterman 2000 34, Argyris and Schon 1996).

Group Action (30 minutes)

Within the small group one person is assigned to record each student's predictions and rationale which are then discussed. The purpose of the discussion is to bring out the behavioral assumptions and attributions students (managers) have about employees. This discussion is what Lewin (1951) refers to as unfreezing behaviors and allows participants to examine the beliefs they have. To stress the dialogue aspect of this exercise, students are encouraged to challenge and discuss without criticizing. The object is to get as many views as possible whereby managers freely express their opinions and experiences.

Running the Simulation

After the discussion, each student is instructed to input their initial decisions and to run the simulation without pausing to change inputs. Once the simulation has run, the student plots the actual results against their prediction. They return to their small groups to compare notes. It is unlikely that any will have been successful. For some, the new hire will have left the company. For some, the new hire is unhappy or will have their resume out. For others, the outcomes will simply not have improved. Students return to their small groups and are asked to develop reasons for the results. The recorder summarizes the results on the flip chart.

After this discussion, the students return to the simulation. This time they are allowed to pause the run at any point, make changes to the inputs, and observe changes in the outcomes. They can repeat the simulation as many times as they want. Their objective is to substantially increase the three principal outcomes of 1) productivity, 2) quality, and 3) errors.

The Simulation Results

What the student will "learn" are the assumptions inherent in the simulation. If workload and control are left at the initial settings and no development programs are selected then the new hire does not leave but productivity and quality both eventually decline and errors increase. Increasing the degree of either workload or control make matters worse. If managers use the default settings for workload and control but now implement the traditional programs, the outcomes only get worse, especially in the later months. Eventually the student will "learn" that less workload, less control and the selection of the non-traditional, systems-oriented programs will yield the best results and allow the student to succeed.

The results should be counter-intuitive to most students. In a "command and control" mindset, a manager would use most, or all, of the traditional programs. The application of pay-for-performance structures has been increasing. As a manager, one is expected to respond to poor performance (or at least below expectations) with increased attention to the poor performer. The response would generally include more involvement in the work of the employee, if for no other reason than to help the employee. The assumption is that it is the employee who is at fault. The response would almost surely include closer monitoring of the "situation" and the application of, at least, positive reinforcement, and perhaps punishment. The response should improve performance. That it does not in this simulation, should raise some important management issues.

The Simulation's Assumptions

Why does the simulation not produce expected results? At this point, the students are shown the model and are taken through the assumptions (A1 through A9) that produce the unexpected results.

A1. The traditional programs are aimed at the individual. They assume that the way to improve performance is to "motivate" and direct the individual. In this simulation, however, performance is constrained by the existing structures that have developed in the company over time. Employees, in general, have little influence relative to the structures; new hires, regardless of their abilities, have even less impact. Within the culture of *this* organization, the ideas of new employees are not valued. In fact, high potential new hires have a history of leaving so their ideas are generally ignored and discouraged. This presents an opportunity to introduce reinforcing loops. The non-traditional programs recognize the influence of the structural

constraints on performance. Selecting these directs the new hire to better opportunities to make effective changes. There is a delay in these effects, however. General systems ideas can be brought in here including the work of Ackoff (1999) and Deming (1994).

A2. The new hires realize they have little influence but that the traditional programs expect them to have influence. They resent the unrealistic expectation and react by decreasing productivity and quality. Over time their attention will be drawn to leaving the organization, certainly not improving it (Deming 1994, Deci and Flaste 1995). The non-traditional programs place the effort in the appropriate areas, the structures.

A3. Workload affects caring. The assumption is that the new hire, as a high-potential new hire, has a high degree of self-efficacy and they will not like being told what to do or how to do it. The new hires expect a fair degree of autonomy and decision latitude. They expect this to be high at the start and to decline over time. If this does not occur, they will experience a series of several possible emotions (e.g., loss of trust, frustration, resentment) culminating in a reduction in the degree to which they care about the company. In the simulation, this is represented as an inverse linear relationship between workload and caring.

A4. Control similarly affects caring. For the same reasons that workload affects caring so does control. High potential new hires do not like to be closely watched and treated like a rats in a cage. They expect to be trusted and left alone to do their jobs. This relationship is also an inverse linear relationship.

A5. The impacts of workload and control on caring are additive.

A6. Caring affects errors in a "V" relationship. Caring in the middle range keeps errors at a minimum. However, as caring decreases errors increase. Similarly, however, as caring increases into the high range, errors also increase. The assumption here is that either 1) the new hire is so caught up in – and excited about – other changes and programs that their attention to detail slips, or 2) they are too overeager and take on too much causing errors to occur. In either case, the errors are due to a "good" thing and the manager's reaction to the errors is critical. It should be noted that the base rate of errors will not change since it is driven by the programs. An investment in the non-traditional programs will decrease the base error rate; an investment in traditional programs will have no effect.

A7. Caring also affects quality, moderated by workload. Quality will be highest when workload is low and caring is high. It is lowest when workload is high and caring is low. If workload is high while caring is high, the new hire will be frustrated. They see what could be done but do not have the opportunity to do it. If the workload is high and caring low, there is waste or a missed opportunity for improvement. Quality will suffer when workload is high and caring is low. The student may be tempted to think of these as independent, but they are not in the simulation. Workload affects caring, therefore they are correlated. Also, quality is constrained by the programs. The traditional programs will not allow significant improvements in quality, only the non-traditional programs will allow this.

A8. Stress is affected by caring and workload. High workload with low caring increases stress while low workload and high caring decreases stress.

A9. Productivity is affected by stress in an inverse linear relationship. Productivity is also constrained by programs.

In summary, there are two main assumptions in the simulation. First, caring is essential for all outcomes. If the new hire cares, then there is the potential for higher productivity and quality. Caring, in turn is a function of workload and control. The assumption about the personality of the new hire is crucial here also. The second main assumption relates to the

programs. It is assumed that the individual has only a limited ability to affect improvements in the outcomes. Significant improvements can only come with substantial restructuring or system redesign. This will not occur with programs aimed at motivating the individual employee.

While it is not the intent to teach system dynamics, the model provides an opportunity to introduce basic systems concepts. Students could be introduced to stocks, flows, interactions, feedback loops, and delays.

Opportunities for Discussion and Learning

Tying the Context to Concepts

The New Hire simulation creates the context for teaching various theories covered in an organizational behavior (OB) class. Table 3 presents the topics usually covered. The simulation principally addresses the individual topics. However, by using groups in the learning process, students are challenged to assess their simulation decisions in relation to OB theories (Caoutte and O'Connor 1998). The simulation can be used to directly address some of the topics, for example, stress, performance, satisfaction, and goal setting. Others can be addressed indirectly. As an illustration, we have selected four OB concepts and describe how they might be tied to the simulation. They are personality, motivation, diversity, and organizational culture.

Table 3 Typical Topics in Organizational Behavior Textbooks

Individual Level	Group/Team Level	Organization Level
Personality Motivation Diversity Perception/Attribution Performance Satisfaction Stress Creativity Decision Making Goal Setting	Group Dynamics Team Effectiveness Leadership Power/Influence Communication Conflict Management Decision Making Performance Management	Organizational Culture Organizational Change Decision Making Design/Structure Politics, Power

Personality

One of the personality theories that ties nicely to the simulation is the Myers-Briggs Type Indicator (MBTI). The MBTI is a valid and reliable instrument based on Jung psychology that illustrates the effect of personality (Isachsen and Berens 1988). It defines four dimensions of personality: extraversion/introversion, intuitive/sensing, thinking/feeling, and judging/perceiving. The first dimension, extraversion and introversion, defines the external or internal orientation of a person. For example, the extravert is linked to the external world and likes interaction with others, whereas the introvert is linked to the internal world of self and is very comfortable with reflective thought. The second dimension, how one gathers information, is defined as either a sensor or an intuitive. The sensor is present oriented and gathers data by using the five senses, whereas the intuitive is future oriented and uses hunches and insights to gather information. The third dimension, how one evaluates information, is defined as either a thinker or feeler. The thinker uses rationality and criteria, whereas the feeler examines how the

decisions impact others. Finally, to assess how one interacts with the world, the MBTI types either as a judger or perceiver. The judger is very organized and structured, whereas the perceiver likes spontaneity and keeping things flexible.

If we assign personalities to the new hires then each of the development programs of the New Hire simulation would impact each of the personalities differently. In addition, the personality of the manager would likely affect which programs he or she selects.

Exercises and discussion questions:

1. Describe your personality in relation to the development programs you selected (see Table 1).
2. Describe how each personality type, as the new hire, would respond to each of the programs.
3. Identify potential personality conflicts between manager and worker.

Motivation

Inputs would have different motivational impacts on employees depending on their skills, ability, and values (Vroom 1964) and affect what people expect from their job. Vroom's expectancy theory, stated simply, is workers are motivated if they perceive a relationship between their performance and their desired outcomes. The details of the expectancy model could be made clearer by having the students develop motivational models that relate performance to each development program. In addition, students could identify obstacles within organizations that block motivation.

The following discussion questions will help the group understand the relationship between motivation and organizational systems.

1. Does increasing workload increase or decrease motivation? Does an increase in control increase or decrease it?
2. What system barriers would affect employee motivation?
3. What values did you assume the new hire has for each of the programs?
4. What skills and abilities would employees need for each program?
5. How could you design a job that motivates?

Diversity

The changing workforce has created new challenges for managers as they determine the best way to develop their resources. Ethnicity, race, religion, age, gender, sexual orientation, physical abilities, and cultural differences represent the major categories that managers must consider when making decisions. What people want from their workplace, the beliefs they have about others, and polices that exist can create or hinder human potential.

The simulation provides an opportunity to explore, often hidden, assumptions about diversity. This simulation was developed by a white male without regard to the ethnicity, race, religion, and age of the participants. How might consideration of diversity change the simulation?

Each group discusses the following questions as it relates to the New Hire Simulation.

1. Identify the categories of diversity that might exist within the department and the organization.
2. Identify the assumptions you made regarding gender, race, and age. Would anything change if new hire was black woman in her 50s versus a white man in his 20s? Would different assumptions be made and would the inputs be different?

3. Would the inputs of the New Hire simulation support diversity in the workplace and why?

Organizational culture

Organizations are comprised of patterns of behaviors that form over time. This culture encompasses beliefs, values, attitudes, expectations, and behaviors (Schein 1985). By paying attention to and rewarding certain behaviors, managers help to maintain this culture (Trice and Beyer 1993). Employees who agree with its values and rewards stay, those who don't leave.

1. Determine the cultural assumptions/implications under traditional versus non-traditional programs.
2. Identify ways the New Hire simulation could be used to develop a learning organization.
3. Distinguish how a bureaucratic versus an entrepreneurial culture might respond to playing the New Hire simulation.
4. Identify development programs that could help change a dysfunctional workplace.

These topics, again, are only examples. What is important for the students is to see that the behavioral topics are interrelated and that mental models affect decision making.

It should be emphasized, especially regarding the criticism of simulations in the past (see Lane 1995), that the simulation was developed by one of the authors. We therefore have an intimate knowledge of the assumptions and an explanation for each one. In this sense we are able to lay our mental model out on the table for review and critique. Ideally the course could continue to explore alternative mental models of students. It should include a "what do you think" phase where students could learn to develop their own hypotheses for comparison and possible testing. How do they think workload, control and stress interact? What is the ultimate effect on productivity and quality? If time permits, the students could be introduced to stocks, flows, and the language of system dynamics.

However, even without explicit coverage of system dynamics, the students have already been exposed to several system thinking concepts: thinking in time, interconnectedness, holistic views of behavior, and a shift from a focus on individuals to systems. If reinforced in other courses, students may begin to see organizations from the systems perspective.

Conclusions

Our objective is to gain a greater acceptance of system dynamics in management education since it is conspicuously absent from some of the leading journals. At the same time, however, management educators recognize the need for better handling of complexity and for theory development. There is also an awareness of the need for systems thinking and the need to work with students' mental models.

In addition, there is also a recognized need in management education for a more rigorous evaluation of its outcomes (e.g., Shaw et al. 1999; Argyris 1997; Lengnick-Hall and Sanders 1997). Our focus for future work is to refine the model and learning environment presented and ultimately test it against alternatives in a longitudinal, quasi-experimental study. The hypothesis would be that system dynamics, while not necessarily providing significant short-term results (although perhaps so), would provide a worldview for more effective long-term results. If the participants can get "hooked" on systems thinking and system dynamics, then would they experience more insight, understanding, and efficacious learning as compared to traditional

methods? Such a program would meet each of the calls noted above by providing 1) for more effective handling of complexity, 2) a technology for generating new theory, and 3) a more rigorous test of effectiveness.

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Back to the Top