How to Use Problem-Solving Simulations to Improve Knowledge, Skills, and Teamwork

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HOW TO USE GROUP PROBLEM SOLVING SIMULATIONS TO IMPROVE TEAMWORK

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Overview

Group problem solving simulations are most often used as an icebreaker or to demonstrate synergy within groups. Such simulations require participants to rank a list of items or sequence a set of activities according to some objective (such as surviving or maximizing effectiveness) and then compare their individual and team solutions to an expert or recommended one. However, these simulations can also be used to improve knowledge, skills, and teamwork.

This guide will enable you to get the most out of using group problem solving simulations by describing some of the key considerations in selecting a simulation, ways of designing your program to meet different training objectives, and how to debrief the simulation to demonstrate the difficulty of achieving synergy, the value of collaboration and consensus, and the importance of rational and interpersonal skills. By understanding how to use simulations as tools (rather than as programs), you will be able to use them in a number of ways that will each create a powerful and unforgettable experience for your participants.

How to Use Group Problem Solving Simulations to Improve Teamwork

So, you've just been asked to lead a training session focusing on team building, group dynamics, or group problem solving. Chances are you will consider using a group problem solving simulation, where participants rank a list of items or sequence a set of activities according to some objective (such as surviving or maximizing effectiveness) and then compare their individual and team solutions to an expert or recommended one.

Such simulations are popular because they are relatively quick and easy to administer, they provide participants with an opportunity to get to know one another, and they can be used to demonstrate the concept of synergy—when the combined efforts of two or more people has a greater effect than their independent efforts. However, simulations can also be used to initiate team building, to build knowledge regarding particular organizational processes or management techniques, and to improve interpersonal and problem solving skills. The key lies in matching the type of simulation, program design, and simulation debriefing to your training objectives.

Content-free vs. Content-Full Simulations

Let's assume that the team-building session that you've just been asked to do has to be conducted within a two-hour time frame. You choose a simulation that focuses on survival when stranded out at sea—a reasonable choice. Because you've used this simulation before, you figure that you can easily administer it, debrief the results, and talk more generally about team building within two hours. What you don't realize is that just about all of your participants, who are project engineers in a nuclear power plant, have been in the Navy. As a result, providing the experts' solution to the simulation ends up taking much longer than expected (given that participants have very strong opinions about their answers). Since you have never been on a boat, much less in the Navy, and you didn't expect to get into a great level of detail on survival at sea, you're not equipped for the unexpected attack. You lose time, you lose face, and you fail to meet your training objectives. What happened?

The particular simulation (not the technique) was a poor choice for this audience given that the objective was teach participants about how to deal with members of their team (rather than how to survive in a school of sharks). While all group problem solving simulations share a common technology (develop individual solutions and group solutions, then compare them to an expert or recommended solution), they differ in terms of the type of problem to be solved by participants. Identifying the best simulation to use given your audience and your training objectives is central to your success in using this type of tool.

Content-free simulations

Content-free simulations focus on problems that participants are not likely to have experienced in the past nor are they likely to experience in the future. Simulations that present participants with a survival problem (in the desert, in the subarctic, in the mountains, in the jungle, in the sea, or in a bushfire) are generally content-free. That is, the content of these simulations (survival in some threatening or remote area) is generally irrelevant to participants' jobs, is likely to be outside their sphere of expertise, and is probably beyond the scope of their role relationships. Instead,

content-free simulations are designed to direct attention to overall group problem solving processes and skills.

Content-full simulations

Content-full simulations focus on problems that *are* likely to be relevant to participants and their work. Simulations that focus on business-related problems and issues, such as conducting meetings, managing projects, negotiating agreements, developing plans, and handling customer complaints, are usually content-full. They are designed to teach participants how to handle the particular work-related problem or issue presented in the simulation. Because they allow comparisons between the quality of individual and group solutions, content-full simulations can also be used for training on group problem solving processes and skills.

Whether a simulation is content-free or content-full depends in large part on your audience and your intention in using the simulation. For example, when the Boy Scouts or a branch of the Department of Defense uses survival simulations, they are generally administering them for the content—to teach people about survival. As illustrated by the two-hour team-building scenario, you run the risk of unintentionally using a content-free simulation as a content-full one when you haven't considered the knowledge and experience of your audience before hand.

Selecting the right type of simulation

Each type of simulation has unique advantages that make one more appropriate than the other for certain situations. *Content-free* simulations generally require less preparation time than content-full ones; given that your purpose is not to teach people about the problem posed by the simulation, you don't have to completely master the expert solution and the rationale behind it. (Video tapes of the expert solution and rationale are available for some of the content-free simulations. The use of these videos can also help to lessen your preparation time by providing closure on the content of the simulation and allowing you to focus on debriefing the processes used in solving the simulation.) Furthermore, content-free simulations generally have fewer items for participants to rank and therefore tend to take less time to administer than content-full ones. Content-free simulations also can help participants to focus on the process of group problem solving (rather than get sidelined by issues and details specific to a single problem).

In general, content-free simulations are preferable to content-full simulations for:

- ✓ breaking the ice at a retreat, off-site, or some other event where your objective is to put people at ease and promote interaction.
- ✓ team building, particularly when you have a limited time frame.
- ✓ building group problem solving skills and assessing the improvement in skills from one simulation to the next.

Content-full simulations have the advantage that they can be used to achieve multiple program objectives. For example, as part of a 26-week project management training program, I use a simulation that focuses on negotiations to kick-off my module and to address two of my training objectives: team building and negotiations. Thus, in a three-hour time frame, I use a single simulation to break the ice and accomplish two of my core learning objectives.

Another advantage of content-full simulations is that they tend to be readily perceived as relevant (as opposed to "a game") and are therefore usually taken seriously right from the start. Relative to most content-free simulations, content-full simulations generally allow more time for

group processes and styles to develop and emerge (since they tend to have more items for participants to rank or sequence).

In general, content-full simulations tend to be the better choice for:

- ✓ kicking off a training session when the content of the simulation provides an overview of what will be covered.
- ✓ breaking the ice with groups that are likely to be critical of "games."
- ✓ team building, particularly when you want to allow more time for group processes and styles to develop or when the content of the simulation itself provides suggestions regarding how to work better as a team (for example, how to plan and conduct meetings or resolve conflicts).
- ✓ building knowledge of specific work processes (such as project management, planning, performance management, negotiations, or organizational change) that are the focus of the simulation.
- ✓ wrapping up a training session when the content of the simulation summarizes and synthesizes key points made during the session.

Simulation Program Designs

Let's go back to your two-hour team-building session. You select a simulation that you've used before, but in the past you used it primarily for breaking the ice. You design your program exactly the same way as when you used the simulation as an icebreaker: You start with a brief introduction of the simulation and your purpose in using it. You organize participants into groups, and have them develop their individual and team solutions. After all teams have developed their solutions, you provide the expert solution, guide participants through the scoring process, and debrief the results in terms of the lessons to be gained from the experience. And that's really all you can do with a simulation—right? Not necessarily.

Simulations are tools, not programs. Therefore, when you're using a simulation, you should consider whether the basic simulation program design (see first column of Table 1) could be modified to better meet your training objectives.

Knowledge-building programs

There are steps that you can add to the basic program design to better tailor the simulation experience to your training objectives. For example, for knowledge-building sessions (second column of Table 1) you could have participants develop a post-discussion individual solution after they develop their team solution (but before you provide the expert or recommended solution). Participants will then be able to assess what they learned from the other members of their group by comparing their initial individual solution to their post-discussion individual solution. In this way, you would be using the simulation as a pre-test and post-test, as well as a tool for building knowledge.

You'll also want to adjust the content and timing of particular activities to fit your training objectives. For knowledge building programs, you will probably want to spend more time on the expert or recommended solution and rationale (and less time on debriefing individual versus group performance scores) than you would when you are using the simulation for icebreaking or team building.

Table 1.
Simulation program designs

PROGRAM 1: Icebreaking (Basic simulation program design)	PROGRAM 2: Knowledge Building	PROGRAMS 3-5: Team Building/Skill Building		
		Program 3: Simulation Only	Program 4: Simulation & Assessment	Program 5: Simulation, Assessment, & Simulation
• Introduce simulation	• Introduce simulation	• Introduce simulation	• Introduce simulation	• Introduce first simulation
• Form teams	• Form teams	• Form teams	• Form teams	• Form teams
• Develop individual solutions	• Develop initial individual solutions	• Develop individual solutions	• Develop individual solutions	• Develop individual solutions
• Develop team solutions	• Develop team solutions	• Develop team solutions	• Begin developing team solutions • Assess group process • Provide feedback on group process • Develop action plans • Finish developing team solutions	• Develop team solutions
	• Develop post-discussion individual solutions			• Assess group process
• Provide expert or recommended solution	• Provide expert or recommended solution	• Provide expert or recommended solution	• Provide expert or recommended solution	• Provide expert or recommended solution
• Score simulation	• Score simulation	• Score simulation	• Score simulation	• Score simulation
• Debrief simulation scores	• Debrief simulation scores	• Debrief simulation scores	• Debrief simulation scores	• Debrief simulation scores
				• Provide feedback on group process
		• Develop action plans		• Develop action plans
				• Administer second simulation • Provide expert or recommended solution • Score simulation • Debrief simulation scores
Approximate time: 1 to 2 hours	*Approximate time: 2 to 3 hours*	*Approximate time: 2 to 3 hours*	*Approximate time: 3 to 4 hours*	*Approximate time: 5 to 7 hours*

Team-building/skill-building programs (simulation only)

For a team-building or skill-building program you will, at a minimum, want to discuss strategies and techniques for improving individual and group problem solving on the job. The simulation provides an excellent forum for such a discussion (see column 3 of Table 1). Having just been through the same problem solving experience, its relatively easy to walk participants through how the problem *could* have been solved using various strategies and techniques that tend to produce higher quality solutions. In turn, participants can readily evaluate where, in both their individual and group's process, they could improve their approach.

In contrast to skill-building programs, you will want to emphasize comparisons between the quality of individual and team solutions (and de-emphasize the expert or recommended solution and rationale) in programs that focus on team building. Comparisons between individual and team solutions can be used to illustrate the value of collaboration and consensus over confrontation and compromise in developing team solutions that are of higher quality than those developed by members working alone. Since simulations allow participants to experience the lessons to be learned, they tend to "stick" longer than when they are taught through less interactive methods or techniques (such as lecture).

Team building/skill building programs (simulation and assessment)
For a more intensive team-building or skill-building program, you can conduct a formal assessment of group processes during the simulation (see column 4 of Table 1). As with the basic program design, you'll start with a brief introduction, organize groups, and have participants develop their solutions individually and with a group. However, halfway through development of their team solution, you could ask participants to assess their group's process (or have observers provide feedback on the group's process). Based on the assessment or feedback, participants can identify strategies for improving their group's approach to the problem. They can then implement their strategies as they finish developing their team solution. Thus, the simulation combined with the assessment enables participants to identify and practice more effective group problem solving behaviors.

Team building/skill building programs (simulation, assessment, and simulation)
Alternatively, if you want participants to see how their original processes impact their performance, you can have them develop their team solution without interruption (see column 5 of Table 1). Either have observers assess the group's process during the team portion of the simulation or have participants self-assess their group's processes immediately after they develop their team solution, but before you provide the expert or recommended solution. After debriefing the simulation scores, you can have observers provide feedback or have participants score their assessment of group process. Participants can then use the feedback or the results of self-assessments to identify strategies for improvement. You could then administer a second simulation to enable participants to test out their strategies and practice more effective behaviors.

Debriefing Simulation Results

Your debriefing of the simulation results is key to achieving your objectives for using the simulation, particularly if your program focuses on team building or skill building in terms of individual or group problem solving. For example, let's consider the two-hour team-building session where you're administering a simulation that you've previously used for icebreaking. You run the simulation and debrief the results the same way as you have in the past, focusing on how groups are usually superior to individuals in solving problems, two heads are generally better than one, and, yes, synergy can occur within groups. On that note, you move from the simulation to the more general process of team building. Now ask yourself, are your participants thinking that the simulation was an excellent reflection of reality? Did the simulation and your debriefing help them recognize problems in their own work group's functioning as a team? Did you achieve your objectives for using the simulation? The answer to all three questions is probably, "no."

When you use a simulation for ice breaking or content knowledge building, your objectives are to large extent accomplished when participants develop their individual and group solutions and compare them to the expert or recommended one. However, when you use a simulation for team building or skill building, your debriefing of the simulation results is a major factor in achieving your objectives. One of the most common mistakes made by trainers is that they view

the simulation as the program and, as a result, fail to realize the importance of their debriefing to facilitating improvement in problem solving and teamwork.

Effective simulation debriefing requires, at a minimum, understanding how to calculate and interpret participants' simulation scores. For programs that focus on team building or improving teamwork, the probability that groups will attain synergy and the value of collaboration and consensus over confrontation and compromise are important debriefing points. For team building and skill building programs, describing the skills and behaviors that influence individual and group problem solving performance will also be an important part of the debriefing.

Simulation scores

In debriefing a simulation, you typically have at least six scores to explain: the individual score, the average individual score, the team's score, the gain score, the best member's score, and the synergy score (see Tables 2a and 2b).

Table 2a.
Simulation Scoring (Individual and Team Scores)

	Individual Solution	Team Solution	Experts' Solution	Difference Between Individual and Experts	Difference Between Team and Experts
Item A	6	4	3	3	1
Item B	2	1	1	1	0
Item C	8	6	7	1	1
Item D	4	2	2	2	0
Item E	7	8	6	1	2
Item F	1	5	5	4	0
Item G	3	3	4	1	1
Item H	5	7	8	3	1
			Totals:	16	6
				Individual score	***Team's score***

Table 2b.
Simulation Scoring (Group Performance)

	Team Number		
	1	**2**	**3**
Average individual score (Sum of members' individual scores divided by number of members on team)	20.5	24	17.8
Team's score (From above)	6	26	12
Gain (loss) score (Average individual score minus team's score)	14.5	-2	5.8
Best member's score (Lowest individual score)	10	15	12
Synergy score (Best member's score minus team's score)	4	-11	0

The *individual score* (Table 2a) is calculated by computing the absolute difference between the member's rank or sequence for each simulation item and the expert or recommended sequence or rank for the item, and then adding the absolute values of the difference scores for all of the items. The individual score reflects the quality of the solutions developed by participants working alone. The lower the individual score, the greater the agreement with the expert or recommended solution and the higher the quality of the individual's solution.

The *average individual score* (Table 2b) is calculated by adding the individual scores of all of the team's members and dividing this sum by the total number of members on the team. The average individual score represents the average level of knowledge and resources that members bring to the group. It also represents the expected level of solution quality if a member were selected at random to solve the problem on an individual basis. The lower the average individual score, the higher the average level of knowledge and resources within the group.

The *team's score* (Tables 2a and 2b) is calculated by computing the absolute difference between the team's rank or sequence for each item and the expert or recommended rank or sequence. The team's score reflects the quality of the solution developed by participants working together as a group. The lower the team's score, the higher the quality of the solution developed by the group.

The *gain score* (Table 2b) equals the average individual score minus the team's score. The gain score reflects the gain (when the difference is positive) or loss (when the difference is negative) in the quality of the team's solution over the solution developed by the average individual member.

The *best member's score* (Table 2b) is the lowest (best) individual score attained by any member of the group. The best member's score represents the highest level of solution quality that could be attained by the group without interaction. For example, if the group were to simply take an average of their members' ranking or sequencing for each item, the solution would not be as good as the best member's solution. Alternatively, if the group were to select a solution from those developed independently by members, the highest quality solution that could be adopted by the group would be the best member's solution. Therefore, the best member's solution represents the best solution that the group can develop without member interaction.

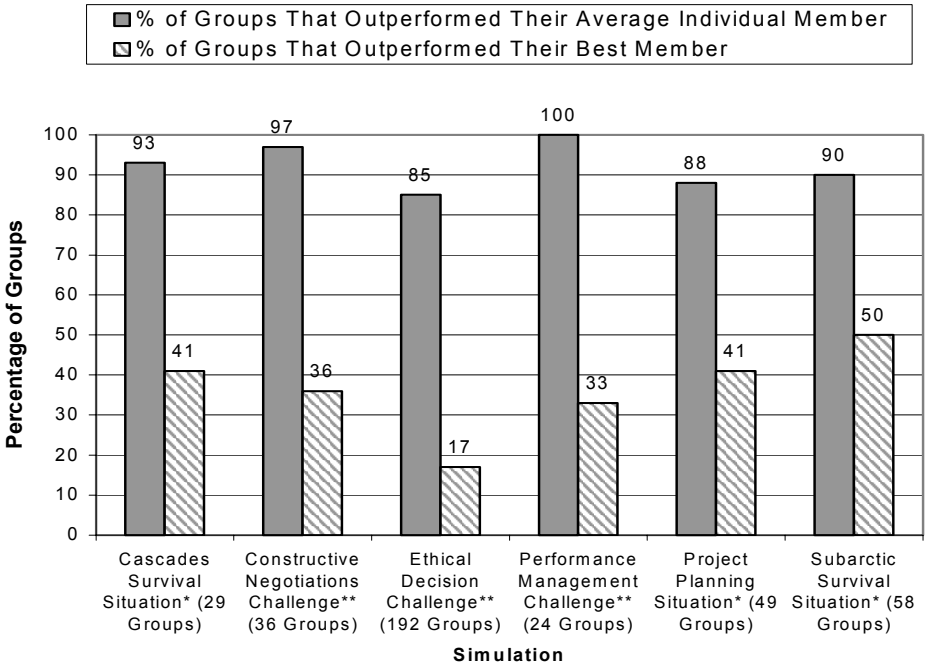
The *synergy score* (Table 2b) equals the best member's score minus the team's score. Positive synergy scores indicate that members' interactive efforts had a greater impact than their independent efforts and that the group achieved synergy. Synergy scores that equal zero suggest that members fully used the resources and knowledge available, but were unable to build on that knowledge to produce something even better. Negative synergy scores suggest that the group did not fully use the knowledge and skills available and, as a result, members' independent efforts had a greater impact than their interactive efforts.

Walking members through the calculation and interpretation of these scores is a great way to make the abstract concept of synergy somewhat more concrete and tangible. In turn, examining the patterns that emerge in group performance scores is an important step in helping participants make the connection between the simulation experience and other group experiences and in making the point that synergy is not easily achieved.

To illustrate the patterns that tend to emerge in group performance on simulations, I've summarized the performance of 388 groups that completed one of six different problem solving simulations in programs run by myself and my colleagues (see Figure 1). With all six of the simulations, *almost all* of the groups outperformed their average individual member. Across all six of the simulations, at least *some* of the groups outperformed their best member and achieved synergy. However, with five of the six simulations, *less than half* of the groups were able to outperform their best member and achieve synergy. (With the sixth simulation, exactly half of the groups outperformed their best member and achieved synergy.)

Similarly, if you were to ask participants how many groups in their organizations outperform their average individual member, they'd probably say "over half." If you asked them how many groups in their organization outperform their best member (and achieve synergy), they'd probably say "less than half." Thus, the simulation scores illustrate that, just as in most organizations, synergy is not automatically achieved by groups. Yet, synergy is what most managers expect when they ask people to work as a group or team.

Figure 1.
Group Performance on Simulations



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Collaboration and consensus versus confrontation and compromise

The simulation scores can be used to demonstrate the value of collaboration and consensus over confrontation and compromise to achieving synergy. Distinguishing between these approaches can be particularly important in programs designed to initiate team building or to improve teamwork.

Collaboration is when members work *with* one another; it is driven by a desire to find the *best* solution; and tends to lead to *win-win* solutions that reflect the views of all members. *Confrontation* is when members work *against* one another; it is driven by a desire to be *right*; and tends to lead to *win-lose* solutions that reflect the views of the most powerful and aggressive member(s). With confrontation, the quality of the solution adopted by the group is only going to be as good as the quality of the solution developed by the most aggressive and powerful member. Even if this person has the best individual score (which is not always the case), the best that the group can do is to match that member's score—thus, they cannot achieve synergy with this approach. With collaboration, however, members seek to find a superior solution that reflects everyone's views. Thus, a collaborative approach is likely to lead members to combine and build on each others' solutions and ideas which is essential to achieving synergy.

Similarly, the simulation scores illustrate how consensus is superior to compromise. With *compromise*, members make mutual concessions or adopt a middle ground. You'll see compromise play out during a simulation when members say "okay, we'll go with my rank for item J and your rank for item B" or "let's average our individual rankings for item K." Thus, compromise is very similar to averaging members' individual ranking or sequencing. Not only does compromise prevent the group from achieving synergy (because members never build on solutions and ideas), it also tends to prevent groups from performing as well as their best member (since that person will also have to make concessions or adopt a middle ground).

With *consensus*, on the other hand, members agree with and support the decisions made by the group. Often, participants think that their groups have achieved consensus simply because members *didn't* prevent the group from adopting a particular solution. However, this does not represent a consensus in terms of achieving a *single opinion* within the group. This becomes apparent when you ask participants to re-rank or sequence the items, on an individual basis, after the groups have developed their solutions. If any member records a solution that differs from the team's solution, the group did not reach consensus and there are still unresolved issues.

When I describe consensus in this way during a training session, usually one or two participants will say "but that would be so hard to achieve." And that's the point. To achieve consensus inevitably requires open discussion and building on ideas, which many groups may not be skilled or experienced in doing. Nevertheless, groups that strive for consensus are more likely to achieve synergy (and develop solutions that are better than those developed by members working alone) than groups that do not work toward consensus decisions.

Rational and interpersonal skills

The simulation scores also reveal something about participants' rational and interpersonal skills. Participants with strong rational skills will start by establishing the goal for solving the simulation, then assess the situation and generate alternative strategies and solutions, identify the potential positive and negative consequences associated with their alternatives, and finally, select a solution to the simulation. Most problem solving simulations are designed so that participants with strong rational skills will attain better individual scores than those with weak rational skills. For example, most simulations are explicit about the goal (survival of all the group's members, maximizing work effectiveness or efficiency, etc.). Participants who recognize the importance of this information will be more likely to develop a answer that is consistent with the expert or recommended solution than participants who miss this piece of information (and develop solutions that do not address the problem).

With group problem solving, members' rational skills are also important in terms of developing a good solution; however, they are not sufficient in terms of achieving synergy. Groups that achieve synergy generally include members who have strong interpersonal, as well as strong rational, skills. Strong interpersonal skills are apparent in groups where all members participate in the discussion, listen to one another, constructively differ, and offer mutual support. For example, it would be difficult for a group to build on ideas if none of the members participate or listen to one another. Similarly, if members continually criticize one another (low support), people are to stop sharing information and ideas with the group (which, in turn, will prevent the group from achieving synergy).

Thus, good (low) individual scores and team scores suggest that participants probably used high quality rational skills when solving the simulation on an individual basis and with their

groups. Poor (high) individual scores and team scores suggest that participants should consider how they could improve their use of rational skills and behaviors when solving future problems. Positive and high synergy scores suggest that participants probably exhibited high quality rational *and* interpersonal skills when solving the simulation with their groups. Negative synergy scores suggest that participants should review the rational and interpersonal aspects of their group's problem solving approach to identify behaviors that should be encouraged (or discouraged) in the future.

The Bottom Line

There's more to group problem solving simulations than just synergy, survival, and icebreaking. Simulations are an off-the-shelf tool—not an off-the-shelf program. They are the most powerful when they are used in a customized way that is tailored to your audience and to your objectives. So, the next time you're asked to do a training session that focuses on team building, problem solving, or knowledge building, consider whether there is a unique way in which you could use a simulation to create a memorable and meaningful experience for your participants.