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TRENDS IN LEARNING GROUP PERFORMANCE IN PROBLEM-SOLVING SIMULATIONS

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Abstract

The paper discusses the application of simulations for group problem solving in management training. The aim is to explore trends in group performance, which can then serve as a starting point for analysis and discussion of decision-making processes during training sessions. The results of the observation of the work process of 113 groups with a total number of participants of about 500 people were obtained from 5 different simulations based on a procedure developed by Human Synergistics. Average individual and group results, the gain/loss from the group discussion and the resulting synergy in the group were calculated as efficiency measures. The results of the Bulgarian groups are compared with those of known published studies and can serve as reference values. Expectations of similarity in the performance trends of individuals and groups are confirmed. The hypotheses regarding the increase in the quality of group decisions compared to the averaged individual results (in 82% of cases) and the relatively limited achievement of synergy (only in 30% of cases) are confirmed. Differences are also established between groups based on belonging to a private or state organization and open groups or members of a team/organization. The observations create a basis for more in-depth discussions during the training sessions on how the quality of decisions can be improved by increasing the quality of interactions between group participants.

Keywords: *Training groups, synergistic problem solving.*

1. Introduction

The decision-making process is of critical importance in all areas of human activity. Some early studies from the 1930s formed the view that groups perform better than individuals due to the effect of accumulating more knowledge and experience, which increases the probability of making a better decision (Shaw, 1932). However, it was later stated that the answer to the question is unclear and there is evidence both for and against this proposition (Maier, 1967). Groups can contribute to a better quality of the decisions made, but also impair the performance of the individuals of which they are composed. Branson et al. point to a number of studies supporting both the advantages of group work and its disadvantages related to inherent characteristics of the group process leading to a decrease in effectiveness (Branson et. al, 2010: 76). The present study takes as its main research question what are the trends in the performance of learning groups compared to individual performance in practical problem-solving learning situations?

2. Factors affecting the effectiveness of group decision making

Effective group decision-making depends on a number of factors. According to Maier, the forces that influence problem solving are group assets, constraints inherent in the group process, and factors dependent on the skills of the leader. The information and knowledge in the group always exceeds that of any individual and the number of approaches to the problem is greater. On the other hand, restraining forces can be group pressure for conformity, the "valence" of decisions (Hoffman & Maier, 1964), dominance of individuals and conflicting side goals (eg, power, winning the argument). However, a number of situational factors should also be taken into account. In addition to the skills of the leader, the essence of the problem and the goal to be achieved are also important. Another key factor that can significantly influence the increase in group performance is the style of interaction between its members (Group Styles Inventory etc., 1990). It is addressed in detail in the synergistic problem-solving model developed by the research organization Human Synergistics (Subarctic etc., 2007: 27-31), which pioneered the development of problem-solving simulations measuring and demonstrating the idea of

synergy. Their mechanism is based on making a judgment and prioritizing a list of items or actions according to their importance to achieve goals such as survival or higher efficiency. The model is built on the premise that when groups adopt a constructive interaction style and their members approach problems in a rational and supportive manner, the collaborative effort of people working together will have a greater impact than the sum of their independent efforts.

According to data in a study of 244 teams, 96% of them achieved a better group score than the average individual score. Respectively, only 4% of the groups failed to improve the average individual score (Subarctic etc., 2007: 55). Another study of 388 groups shows that the percentage of them that improve the average individual score varies between 85-100%, and of those that improve the best individual score and achieve synergy is in the range of 17-50% (Szumal, 2000).

The present study aims to investigate to what extent Bulgarian groups make decisions of a higher quality than individuals and achieve synergy. Based on the known data the following hypotheses were formulated: 1. The trends in the results of the same simulation for foreign and Bulgarian groups will be similar. 2. The quality of group decisions will in a comparably high percentage of cases be better than the quality of averaged individual decisions. 3. Synergistic groups will be a significantly lower percentage - less than half of all groups, confirming that groups do not achieve synergy easily.

It can be assumed also that the quality of interaction in groups is likely to depend on whether the people know each other and have experience working together. Thus, there is reason to expect that groups consisting of members from one organization or team will achieve better results than open groups composed of people who do not work collaboratively. Also, the dynamics of work in private business suggest greater pressure for efficiency and results, and a higher need to develop teamwork skills, group decision-making, and higher-quality interactions. Therefore, it is interesting to check if the groups composed by participants working in private organizations achieve better results than those working in public organizations.

3. Methods

This study includes the registration of the results of the group problem solving of 113 groups, most of which are 4-6 people, with the exception of several groups consisting of 3 or 7 participants. The total number of participants amounts to over 500. The study covers 5 different problem-solving simulations conducted as part of open or corporate management trainings. Participants in the study are both real teams working in private business organizations and in the public sphere, as well as open groups, including students and managers from the Master's and Professional Management Programs of New Bulgarian University, and participants in other management skills trainings.

Table 1. Types of group participants.

Types of groups	No
Groups from one organization	**42**
- Private Business (8 organizations)	37
- Public Organizations (2 organizations)	5
Open Groups	**71**
- Private Business (in a wide range of sectors)	36
- Public Sphere (Directors of VE schools)	35

Table 2. Distribution of groups in simulations.

Types of simulations	No groups
Envisioning a Culture for Quality	60
Subarctic Survival Situation	33
Organizational Change Challenge	10
The Stuck Truck	7
Managing Transitions	3
Total groups:	**113**

These simulations were held between 2009 and 2022. Three of the simulations were developed by Human Synergistics, the first being perhaps their most popular simulation - the Subarctic Survival Situation (Lafferty, 2007). The other two are: Organizational Change Challenge (Szumal, 1998) and Envisioning a Culture for Quality (Cooke, 2004). The fourth simulation is The Stuck Truck, developed by R. Baker and D. Kolb (Baker & Kolb, 1990), and the fifth is Managing Transitions based on a case published in the W. Bridges book of the same name (Bridges, 2003).

The procedure for conducting simulations follows the leader’s guides of Human Synergistics (Subarctic etc., 2007; Envisioning etc. 1993; Szumal, 1998) and lasts an average of about 2 hours. In the procedure for calculating the results of simulations as the main indicators of efficiency are the obtained individual scores (IS), the group score (GS) the best individual score (BIS) in the group, the average individual score (AIS), gain/loss score (comparison between AIS and GS) and the resulting synergy (comparison between GS and BIS). IS and GS are calculated by summing the absolute differences between the participants' rates and the best solution (expert or obtained in research) of the arrangement of the items from the list. The lower the values, the smaller the deviations, i.e. the solution comes close to the best and therefore has a higher quality. AIS is calculated as the sum of the ISs of the group members is divided into their number and is a measure of the average level of knowledge and resources they bring

to the group. It can also be considered as an indicator of the expected level of decision quality if a member of the group is elected randomly to solve the problem. GS in turn, is a measure of the quality of the decision made by the participants working together as a group. Groups can improve the quality of the solution if they achieve a lesser deviation of the GS than AIS over the best solution. However, this does not yet mean achieving synergy. The calculation of synergy is done by GS being subtracted from the BIS. The positive value obtained indicates that the interaction of people in the group achieves a higher quality than each of the individual decisions, i.e., the synergistic solution is better than the mechanical sum of the individual solutions.

4. Results

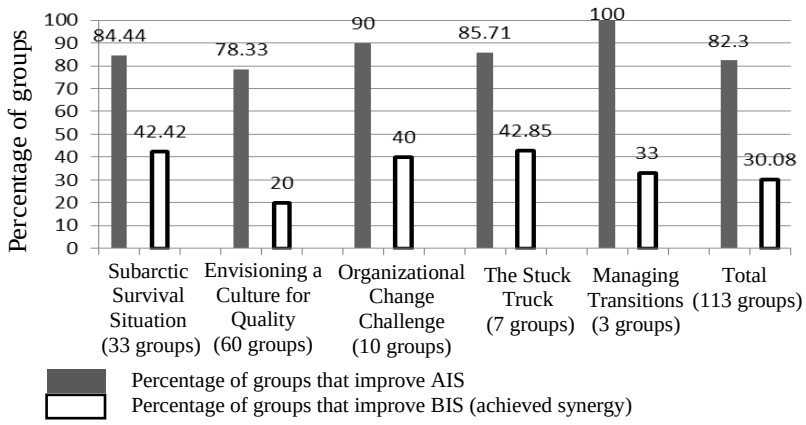
According to the study of a sample of 58 groups, the results of the Subarctic Survival Situation in 90% of cases are achieve a better group score than the average individual and in 50% of cases achieve a better score than the best individual score (Szumal, 2000). The results of the same simulation in the present study on 33 Bulgarian groups are slightly lower, but the tendency is similar: 84.44% of the groups achieve an improvement in AIS (28 of 33) and 42.42% achieve better results than BIS (14 of 33). This gives reason to confirm the first hypothesis of this study. Confirmation of the results can be considered as verification, both of the observations so far and the validity of the Bulgarian adaptation of the simulation.

Table 3. Comparison of the results of the Subarctic Survival Situation in the US and Bulgarian study.

No.	Indicators	Scores of 244 groups (Subarctic etc., 2007: 55)		Scores of 33 BG groups
		Total	Poorly performing	
1.	Average individual score	47,3	50	60,5
2.	Average group score (GS)	29,8	40,9	49,1
3.	Average Gain/ Loss in group work	17,4	9	11,4
4.	Average best individual score (BIS)	32,5	36,4	46,2
5.	Average difference between the BIS and GS	2,7	-4,5	-2,9
6.	Groups that improve the average individual score	96%		84,4%
7.	Groups that do not improve the average individual score	4%		15,2%

The results show similar trends, as well as in the cited study by Human Synergistics of the same simulation, where 96% of the groups improve AIS. The comparison of the results in Table 3 also shows that the groups in it generally do better than the groups in the present study which are much closer to the results of the sample of poorly performing US groups including the value of gain which is insignificantly higher. The best individual results in the Bulgarian sample are also clearly weaker, i.e., the knowledge, skills and experience to solve the problem are lower. One possible reason for this could be related to cultural characteristics that determine the competence of the participants in both samples. However, the amount of gain/ loss in group work is also lower and the share of groups that do not improve is significantly higher (15.2% compared to 4%). This should no longer be relevant to the competence of the participants as to the quality of group interaction in the Bulgarian groups. It is necessary to interpret the data with a high degree of caution due to the small size of the Bulgarian sample and its disproportionateness relative to the control group, including their placement in distant periods of study. However, they can serve to compare the general trends of the performance of the groups.

Figure 1. Trends in the performance of groups in the five simulations.



The trends in the performance, observed in all 113 groups, participated in one of the five simulations are depicted in Fig 1. The share of groups that improve the average individual score varies between 78.33-100% (85-100% in Szumal), and those who improve the best individual score and achieve synergy is between 20-42.85% (17-50% in Szumal). In total, for all 113 groups, the results are 82.30% (93 groups), respectively, improved AIS and 30.08% (34 groups) that improved BIS.

The results regarding synergy show that in one of the simulations covering over half of the sample, the ratio is 1 in 5 groups. In three of the simulations, just under half of the groups achieved synergy, close to the results in the cited study of Szumal describing one of them. In general, synergy achieves an average of only 1 in 3 groups, which, despite the use of different simulations, is comparable to that of the Szumal study (Szumal, 2000) and gives grounds to confirm both the second and the third hypothesis of the present study.

To examine the alleged influence of the established group collaboration on the results, the sample was divided into two parts, based on whether the participants are from one organization, work in one team or at least joint (company groups, n=42), or are enrolled in an open training program, including strangers and colleagues from different organizations (open groups, n=71). The results of the comparison are presented in Fig 2, where the difference in AIS improvement is 9.22%, and in BIS 12.74% in favor of company groups. In general, the data testifies to support the grounds for confirming the expected results. However, care must be taken with the conclusions, as the two compared groups participated in different simulations and their results may have a cross-influence of factors related to their content. It is likely that differences are due, for example, to differences in the difficulty of simulations and the level of success in each of them.

Figure 2. Comparison between the performance of company and open groups.

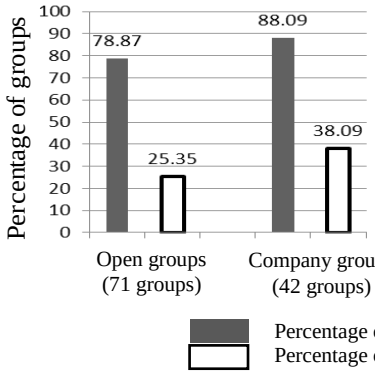
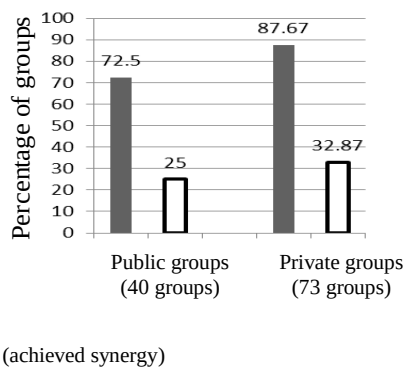
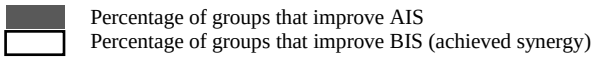


Figure 3. Comparison between the performance of groups in public and private areas.





To check the alleged influence of the different dynamics of work in the private and public area on group interaction skills and the results, the sample was divided into two parts, based on whether the participants are members of public (n=40) or private organizations (n=73). The results of the comparison are presented in Fig.3, where the difference in AIS improvement is 15.17% and in BIS is 7.87% in favor of private groups. The data testifies to support the conditional acceptance of this expectation too.

It should be noted that the comparisons made do not have the rigor and accuracy of a statistical analysis. They only show trends in the performance of the groups. However, the expressed trends in the results are indicative and set grounds for more precise future research.

5. Using results to improve the quality of group processes

According to the model of Human Synergistics, there are two groups of key factors that contribute to effective decisions. The first group includes the skills and knowledge of the group members and the resources they have in regard to the problem. The second group of factors refers to the quality of the skills for rational thinking and interpersonal interaction of participants, i.e., to the emerging group process in solving the problem. (Subarctic etc., 2007: 29).

The established tendencies in the performance of the groups can serve as a starting point for analysis and discussion of the quality of group decision-making and the search for answers on how decisions can be improved. Usually, participants are interested in how they did, for which they receive an immediate answer by comparing expert answers. However, the calculated difference has greater value if compared to the results of as many other groups as possible.

To this end, for the two simulations where there is an accumulation of data, the average values and standard deviations of the measured criteria were calculated (Table 4). They can be used as

benchmarks for comparison. The range of average scores is presented in the table. Values outside it can be considered respectively as significantly low and high results.

Table 4. Comparison criteria.

AIS	Group score (GS)	Gain/ Loss	BIS	Difference BIS & GS
Subarctic Survival Situation, N=33				
$\bar{X}$ = 60.5 σ = 6.2 low< 53 – 66 <high	$\bar{X}$ = 49.1 σ = 12.8 low< 36 – 62 <high	$\bar{X}$ = 11.4 σ = 10.9 low < 0 – 22 < high	$\bar{X}$ = 46.2 σ = 9.1 low< 37 – 55 < high	$\bar{X}$ = -2.9 σ = 13.2 low < -16 – 10 < high
Envisioning a Culture for Quality, N=60				
$\bar{X}$ = 98.4 σ = 11.3 low< 87–109 <high	$\bar{X}$ = 86.5 σ = 14.9 low< 71–101 < high	$\bar{X}$ = 11.9 σ = 12.6 low < -1 – 24 < high	$\bar{X}$ = 79.0 σ = 12.6 low< 66 – 91 > high	$\bar{X}$ = -7.5 σ = 12.5 low < -20 – 5 < high

Based on the comparison of their position against the criteria, participants can analyze the quality of their interactions and seek an explanation of the reasons for their results. This can be done using carefully designed questions that target the characteristics of the group process or through retrospection using coaching questions such as "What did we do well?", "What prevented us from achieving a better result?", "What would we change next time?" After identifying areas for improvement, group members can plan how to work on developing the necessary skills and reassess how they handle a later situation.

6. Conclusion

The results of the study unequivocally show that the quality of group decisions is in a very large number of cases better than that of a randomly taken individual in the group (measured by AIS). However, this is not the case when it comes to the quality of the group decisions compared to those of the best participants in the groups (BIS). Less than one-third of the groups manage to achieve a better solution, which means that in the other two-thirds of the cases, there is a better individual solution that has failed to manifest and accept. In other words, groups could improve the quality of their decisions if they identify their most competent members and listen to them. However, in order for this to happen, a high quality of interaction is required, related for example, to the rational structuring of the group process, specific leadership and achievement of the most constructive rather than defensive style of communication between participants. Obviously, such a quality is more difficult to achieve, which is why it is necessary for it to become the focus of working with the groups after the simulations.

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