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LOW COSTS, LOW BENEFITS? – IMPROVEMENT OF PROBLEM SOLVING IN GROUPS BY MEANS OF ELECTRONIC FACILITATION

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У статті розглядаються дослідження груп за допомогою техніки модерацій (PROMOD). У дослідженні було протестовано, чи може PROMOD покращити показник працездатності як групи, так й окремої одиниці.

Ключові слова: техніки модерацій, процесуальні витрати, групова працездатність, віртуальна группа.

Teams bear responsibility – whether in economic, politic or legal issues. It is more common for groups, rather than individuals, to solve important problems and make difficult decisions. In this way the knowledge of experts can be shared and the various outlooks of a society can be taken into consideration. Because of virtual networking it is no longer necessary that group members share space and time: *C*omputer *S*upported *C*ooperative *L*earning respective *W*orking (CSCL/CSCW) is applied in order to reduce costs and to achieve comparable results as traditional cooperating teams. Unfortunately process loss seems to describe the work results of (virtual) teams better than process gains or synergy effects.

Ordinary teams have to organize the problem solving process by themselves and thereby loose precious cognitive resources. Furthermore, groups have to cope with the motivation loss of their members (see Lecher & Witte, 2003). *Social loafing* takes place in teams so that the output of one group member is reduced in comparison to her or his individual working results. Also people tend to lower their own productivity when they perceive other group members as less willing to strive than themselves (*sucker effect*). *Groupthink* processes are responsible for the extraordinary dangerous results of wrong group decisions due to inappropriate evaluation of problems and the existence of mind guards which prevent controversial remarks (which in turn leads to confirmation rather than scrutinization of arguments). Compromises are made too fast and people adjust their performance standards to those of other group members who hold lower ones. Given the status differences and the missing anonymity of conventional interaction it is difficult for co-workers to assess correctly their colleagues' proposals or solutions. Groups tend to share information that is known by everyone; therefore information pooling has to be regarded as inefficient. Turn taking as a social convention makes it more difficult to utter important thoughts when they form (*blocking effect*) and often remarks are not as comprehensible for others as they should be. Finally, neither too low nor too high group cohesion is conducive to problem solving and decision making. In the first case the tension in the working party strains the working atmosphere and makes it even harder to find a sensible solution for a problem. At the further extreme, people have to maintain a lot of socio-emotional activities so that many resources are wasted.

But still team work is necessary and offers interesting potential. So many facilitation techniques have been developed to avoid the peculiar problems related to the natural interaction of people in groups in a problem solving and decision making context, for example brainstorming, the Delphi method, advocatus diaboli, and dialectical inquiry. At Hamburg University, Germany PROMOD (PROzedurale MODeration or procedural facilitation) was designed to overcome those difficulties which regular groups have to face (Witte & Sack, 1999; Witte, 2007). Dörner's suggestions (1992) for correct solving of complex problems have been reconsidered as well as the need for anonymity and comprehensible statements. In the dialogue phase group members work alone and interact solely with a personal facilitator who encourages them to improve their individual output twice and gives personal, motivating feedback. Afterwards, in the consensus phase those proposals for problem solving strategies are exchanged round-robin without allowing

the group to meet each other. The individual is forced to comment on the ideas of her or his colleague without knowing exactly who conceived them. At the end everyone has the opportunity to integrate those comments into their own proposals. The group votes and a statistical result of the ballot is generated. In this anonymous manner, conformity is substantially reduced and the difficult effects of too low or high group cohesion are prevented because communication is task-focused. The problem solver can rely on external storages and does not need to remember everything by him/herself - insuring blocking effects do not take place. Group members are forced to increase the comprehensibility of their ideas and the direct communication with the facilitator who is able to identify the creator of the problem solution reduces social loafing. Therefore, the individual output is also improved.

There are several options for using PROMOD in a virtual context, namely video and telephone conferences, chat, and email. Depending on the medium used, the features of communication vary: simultaneity, synchrony, sequentiality, visual and auditory perceptibility (Driskell, Radtke, & Salas, 2003). PROMOD relies heavily on the usage of written information so therefore the implementation should not solely rely on video or telephone conferences.

Teams which interact without facilitation have to face several influences which have a negative effect on the group output: waste of resources from self-organizing the interaction, motivation loss, problems connected with extreme cohesion, conformity and suboptimal information pooling. These difficulties are also relevant for virtual teams but could be overcome when using PROMOD. Facilitated groups should do better than non-facilitated groups when solving problems (H1). The electronic implementation of PROMOD tries also to improve the output of the individual so that we expect advantages for facilitated persons who solve a problem on their own (H2). One rationale for working parties is the possibility that several experts can meet and thereby exchange their specific knowledge. So facilitated groups should outperform facilitated individuals in a problem solving task, even when working in virtual frame (H3).

180 persons took part in the experiment at Hamburg University, Germany to receive a certificate necessary for carrying on studying psychology at this university. The sample had an average age of 24.06 years (*SD* = 5.48) and 73.9% were female.

Performance in problem solving was measured with the *Desert Survival Problem* (Lafferty, & Pond, 1974), which can be considered as simple interpolation problem (Dörner, 1992). Fifteen objects had to be ordered according to their relevance for survival after a hazardous air crash in the desert. The order of the objects was compared to one made by desert experts: the sum of the differences between those two orders depicts the quality of the problem solution of the group or the individual. Also the experiment had to decide whether to stay at the place where the plane crashed or to leave, the former decision being the correct one. The positive correlation between those two measures of performance quality is significant ($p = .01$), but rather on low level ($r = .22$).

Besides socio-demographic information like age, sex, school education and university subjects studied, we asked the test person with one-item measurements how many difficulties they experienced while using the computer, the programme and the keyboard in the experimental situation. Furthermore we used the scale suca (Sicherheit im Umgang) of the inventory INCOBI (Inventar zur Computerbildung; Richter, Naumann, & Groeben, 2000) to measure the overall experienced computer skills of our subjects. Item 2 und 5 had to be excluded from the scale, because otherwise Cronbach's Alpha as a reliability-coefficient would have sunken from $\alpha = .75$ to $\alpha = .02$ respectively $\alpha = .01$.

The two factorial experiments had the conditions "Facilitated Group" ($n = 60$), "Facilitated Individual" ($n = 30$), "Non-Facilitated Group" ($n = 60$) and "Non-Facilitated Individual" ($n = 30$): So we have to distinguish between the factor "Group" and the factor "Facilitation". The distribution of the test persons to the four experimental conditions took place in a randomized manner. Only one female facilitator looked after all subjects who worked with up to 5 other persons in one same room.

At the beginning all test persons read in a chat window that they should avoid speaking respectively they should ask the facilitator (or the group) or comment something only with the help of the chat. Afterwards they were asked to become familiar with the chat programme; for this purpose they received screenshots which explained its most important functions. Text messages in the chat window prepared groups and individuals for the following examination: They were informed if and how they would work together with the other subjects and facilitated groups and individuals experienced an affect reduction which called them to find the most correct and rational solution for the problem. Afterwards, the test persons read the

problem to solve and marked the text for better cognitive processing. The phase of problem solving was differently manipulated for the facilitated and non-facilitated conditions: PROMOD-facilitated individuals and groups worked in electronic forms and they were requested to name the two completely different strategies for survival, to order their opportunities and risks and to assign the 15 given objects to those advantages and disadvantages. They had the opportunity to mark those objects they considered as dangerous and those of which the functions appeared unclear to them. Explicitly, they had to decide on one survival strategy and one order of objects. After a standardized time interval every work item was announced by a sound and a short message of the chat programme. After this working phase the test persons could review their whole conception and were requested to send the form to the facilitator which was demonstrated once again by a screenshot. Receiving a motivating feedback the subjects were asked to improve the comprehensibility of their ideas. With this step the main examination of the facilitated individuals ended, whereas those test persons in condition “Facilitated Group” twice exchanged their forms to comment on the ideas of the drafter (receiving documents was demonstrated with a screenshot). She or he had one last opportunity to edit her or his order of objects and the decision between the two survival strategies.

Non-facilitated individuals and groups were requested after the first phase of getting in touch with the computer to develop an order for the 15 objects and to decide for one survival strategy. Non-facilitated individuals as well as non-facilitated groups got a form where they could sketch thoughts, problems, etc. They also received a screenshot which showed them the usage of the form. To assure that the non-facilitated groups had the same opportunities for exchanging of ideas as the facilitated groups, we provided them with two screenshots which instructed them to send and receive documents.

The duration of the working phase was identical for facilitated and non-facilitated groups as well as for facilitated and non-facilitated individuals.

In all conditions chat was used as a communication medium. The test persons worked with electronic forms which could be exchanged with the help of the chat programme. Because of that, the influence of the communication medium on the dependent variables is constant for all conditions and insofar negligible.

At the end of the examination procedure, the test persons had to fill out questionnaires which inquired socio-demographic information, diverse one-item measurements and the subscale SUCA of the inventory INCOBI. They were also asked about their well-being, effort and motivation during the examination; the results of those inquiries will not be presented because of the scarce space.

With the help of multivariate analysis of variance (MANOVA) we tested if our control variables were meaningfully associated with the four experimental conditions. For neither age, sex, the subscale SUCA of the inventory INCOBI nor for the one-item measurements usage of the computer, usage of the keyboard and usage of the chat-programme did we find significant confounding associations with experimental factors ($F_{Facilitation}(6) = .417$, $F_{Group}(6) = .568$, $F_{MxG}(6) = 1{,}443$). So it is not probable that test persons in the facilitated conditions dealt better with the computer then those in the non-facilitated. This means that the performance difference in the usage of computers in general do not seem to be a reason for the better results of the facilitated groups and individuals.

Another MANOVA was conducted to explore global significant influences of the independent variables on the dependent ones (in this calculation also those other dependent variables “Well-being”, “Effort” and “Motivation” have been processed). Just for the factor “Facilitation” it was possible to show a meaningful association to the various dependent variables ($F_{Facilitation}(5) = 5.057$, $F_{Group}(.000) = .000$, $F_{MxG}(.000) = .000$). Thus far our third hypothesis, that facilitated groups outperform facilitated individuals while problem solving, has to be rejected.

In our first and second hypothesis we predict performance advantages for facilitated groups (H1) and individuals (H2) in comparison to non-facilitated test persons, when they have to solve a problem. Performance was measured in our experiment as quality of the order of the 15 objects according to their survival relevance after a plane crash and as quality of the decision between the two survival strategies. For the first measurement we can confirm neither H1 nor H2: Both T-tests became not significant ($T(58) = -.326$, $p = .75$; $T(37.98) = .102$, $p = .92$). So for this kind of problem solving task it is not important if a group or individual is facilitated or not. Arithmetic means and standard deviations for all conditions are as it follows: $M_{Facilitated\ Groups} = 57{,}73$ ($SD = 12{,}22$), $M_{Facilitated\ Individuals} = 64{,}00$ ($SD = 15{,}37$), $M_{Non\text{-}Facilitated\ Groups} = 57{,}33$ ($SD = 12{,}50$), $M_{Non\text{-}Facilitated}$ Individuals = 65,07 ($SD = 9{,}26$).

But the quality of the decision between the two survival strategies could be meaningful improved. T-tests showed a significant performance improvement for facilitated groups and individuals in comparison with non-facilitated groups and individuals. Table 1 summarizes the results of those two T-tests.

Table 1.
T-tests comparisons between the conditions “Facilitated Groups”[a] and “Non-Facilitated Groups”[a] as well as the conditions “Facilitated Individuals”[b] and “Non-Facilitated Individuals”[c] (performance measurements: quality of decision between two survival strategies after a plane crash)

Factor Group	M		SD					
	Facilitated	Non-Facilitated	Facilitated	Non-Facilitated	D	df	T	p
Group	.3330	.1330	.34268	.27356	.64909	36.222	2.040	.0245
Individual	.3333	.0357	.47946	.18898	.86708	56	3.068	.0015

[a]N=20 , [b]N=30 , [c]N=28

The reliability of the subscale SUCA of the inventory INCOBI (Richter, Neumann, Groeben, 2000) has to be critically evaluated. How meaningful the measured data is, if Cronbach’s Alpha is α = .75, remains unclear. In a further examination one should try to avoid having more than one subject per room, not least because test persons can get to know each other before the experiment starts and conformity processes may take place.

But we do not doubt the general analyzability of the data. Interestingly the two measurements of performance are differently influenced by the manipulation of the “Facilitation”-factor. The quality of the order of the 15 objects was not improved in the facilitated conditions, but those groups and individuals who were supported with PROMOD had a significantly greater tendency to choose the correct survival strategy than non-facilitated test persons. The detailed structure in the dialogue phase of PROMOD helps to clearly evaluate the chances and risks of both strategies and makes it easier to choose the right decision and to get rid of heuristics. Groups have the same possibility to structure the problem as individuals which could explain why they do not experience any performance gain (in the facilitated conditions). Heuristics do not help for ordering the 15 objects, so test persons may be more motivated to listen to each other and exchange thoughts. The subjects were not desert survival experts. Perhaps PROMOD would have a positive influence on performance in such a problem solving context if we would have invited such specialists.

User-friendliness certainly has to be improved so that the usage of PROMOD could be possible without any additional help such as screenshots. Special effects and a pleasing user interface could increase the enjoyment of working with PROMOD. Lange’s *ePROMOD* tries to orientate on this standard, but experimental examination of this software has to be done. Furthermore, we need more experiments which test methods of implementing PROMOD other than chat. For example it would be possible to have PROMOD in an email version. We should try to make it easier for users of PROMOD to be persuaded by the correct ideas of their partners. So this facilitation technique could be substantially improved.

Group members shouldn’t interact freely with each other if we want them to produce good solutions and not only saving money. This is true for either an electronic or a conventional frame. We should invest in facilitation techniques such as PROMOD to assure that groups can do their job well.

REFERENCES

1. *Dörner D.* Problemlösen als Informationsverarbeitung. – Stuttgart: Kohlhammer, 1976.
2. *Driskell J.E., Radtke R.H., Salas E.* Virtual teams: Effects on technological mediation on team performance // Group Dynamics: Theory, Research and Practice. – 2003. – №7. – P. 297-323.
3. *Lafferty J.C., Pond A.W.* Desert survival situation. – Plymouth, MI: Human Synergistics, 1974.
4. *Lange M.* Webbasierte Moderationsunterstützung am Beispiel der Prozeduralen Moderation. – Universität Hamburg: Diplomarbeit, 2005.

5. *Lecher S., Witte E.H.* FORMOD und PROMOD: Zwei Moderationstechniken zur Verbesserung von Entscheidungen in Gruppen // Zeitschrift für Arbeitsund Organisationsspychologie. – 2000. – P. 73-86.
6. *Richter T., Naumann J., Groeben N.* Das Inventar zur Computerbildung (INCOBI): Ein Instrument zur Erfassung von Computer Literacy und computerbezogenen Einstellungen bei Studierenden der Geistes- und Sozialwissenschaften // Psychologie in Erziehung und Unterricht. – 2000. – № 48. – P. 1-13.
7. *Witte E.H.* Toward a group facilitation technique for project teams // Group Processes & Intergroup Relations. – 2007. – № 10. – P. 299-309.
8. *Witte E.H., Sack P.M.* Die Entwicklung der Gruppenmoderation PROMOD zur Lösung komplexer Probleme in Projektteams // Psychologische Beiträge. – 1999. – № 41. – P. 113-213.

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