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Creativity and Innovation in a Military Unit of South America: Decision Making Process, Socio-Emotional Climate, Shared Flow and Leadership

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***Abstract*—**This study examined the association between creative performance, organizational climate and leadership, affectivity, shared flow, and group decision making. The sample consisted of 315 cadets of a military academic unit of South America. Satisfaction with the decision-making process during a creative task was associated with the usefulness and effectiveness of the ideas generated by the teams with a weighted average correlation of r = .18. Organizational emotional climate, positive and innovation leadership were associated with this group decision-making process r = .25, with shared flow, r = .29 and with positive affect felt during the performance of the creative task, r = .12. In a sequential mediational analysis positive organizational leadership styles were significantly associated with decision-making process and trough cohesion with utility and efficacy of the solution of a creative task. Satisfactory decision-making was related to shared flow during the creative task at collective or group level, and positive affect with flow at individual level.

***Keywords*—**Creativity, innovation, military, organization, teams.

I. Introduction

CREATIVITY and innovation are important for successful performance and long-term survival of organizations, and successful teamwork is a key process. In this paper we examine how organizational and leadership variables are related with teamwork performance of a creative task, analyzing specifically how optimal experience or flow during a teamwork creative performance are linked with satisfactory decision making and positive affect.

A. The Objectives of Research

This study seeks to examine how the organization's vision is associated with the experience of working in a group, on a specific creative task, in which people must solve a dilemma and propose a solution, both individually and collectively. In this way, their experience during decision making to generate solutions, including their affectivity and the degree of absorption and gratifying challenge or flow during the task, is examined in their interrelationship, as well as in relation to creative performance. The first specific objective of research was to examine the association between decision-making process and organizational factors, mainly leadership styles. The second objective was to evaluate the role of leadership in decision making during a creative performance. The third objective was to examine the simultaneous association between positive affect and individual flow, and decision-making and shared flow at collective or group level during a creative teamwork activity, using a multilevel analysis.

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II. Previous Studies

There is evidence to suggest that the level of organizational innovation increases with the use of working teams. Research has found that a high quality and innovative leadership and a positive climate are contextual factors associated with work team performance, including creative one [1], [2].

- H1. Organizational climate and leadership have a positive influence on creative performance during a work team task.

Flow is an optimal experience of challenge that provokes concentration and positive effects of gratification performing an activity, like a creative task, and shared flow is the optimal experience of working together in a collective task [3]. Previous studies have shown that flow (particularly shared flow) is associated with a greater degree of cohesion, integration and social identification, and better task performance [4]. It has also been found that shared flow or flow in a social context is associated with greater positive affectivity [5]. Creative performance in-group involves the same general facets of group decision-making to solve a problem, namely sharing information to understand and define the dilemma or task, generating alternatives, evaluating them to choose the best, and adhering to the result and the group. A satisfactory group decision-making context is expected to contribute to the optimum nature of the task to be carried out [4]. A study focusing on the relationship between transformational leadership and optimum experience or flow in a work context [5] found that transformational leaders help create a climate of contribution, acknowledgment and challenge, thus provoking the experience of flow among members of the working team.

- H2. Creativity performance is expected to be associated with more satisfactory decision-making processes, greater

experience of flow in group activities, positive emotions, and positive leadership that in turn are also linked.

Shared flow refers to perceived absorption in a challenging experience, such as the search for a solution to a problem/ dilemma. Positive affect, flow and satisfactory group decision making are associated [6]. A satisfactory decision making context enhances the relation between positive affect and optimal experience

- H.3 a) At collective level it is expected that a high group mean of satisfactory decision-making should enhance collective shared flow.
- H3 b.) At individual level is expected that a higher level of positive affectivity is directly related to a greater shared flow in the individual experience.
- H3 c.) A cross level interaction effect is expected: higher mean group of decision-making should reinforce the strength of association between personal affect and individual shared flow

III. Methodology

A. Participants

The number of people participating in this study ranged from N = 315 (global sample) to 92 people (sample for Task 4 for mediational analysis). All were military cadets from an institute of higher military education in Latin America. They were in 3rd and 4th year and belonged to different weapons (31% infantry, 13% artillery, 12% communications and engineering in equal percentage and 11% to cavalry) and specialties (13% to arsenals and 7% to quartermasters). 88% of the sample reported being male and 12% female, ranging from 20 to 29 years (M = 23.52, SD = 2.39).

B. Procedure and Instruments

A task booklet was randomly given to participants to be completed in a single 60-90 minute session. Creativity was assessed by means of ad hoc tasks. There were different tasks, but we focused on describing task 4 that is the task analyzed in mediational analysis. In T4 participants were asked to complete the following task: there are 10 uncontaminated people standing beside a shuttle ready to board. The governments have to eliminate some of them, because the rocket only has space for 5 people. The people are: a pregnant woman, a judge, a singer, a teacher, a nun, a farmer, a builder, an economist, a student and a police officer. Participants were asked to select the 5 people to be saved, in order of preference (1 = first to 5 = last). Phase two consisted of repeating this same task as a group. Participants were then asked to rate (working individually) the usefulness and efficacy of the ideas provided by the team (a) and those provided by individuals to the team (b) when resolving the problem/dilemma posed in the proposed context by the task. In both cases, answers ranged from 1 = not very useful/effective to 10 = very useful/effective. This was an indicator of the usefulness-efficacy of both the team, and the individual.

F.I.N.O. [7], Factors of Innovation in Organizations Instrument: The following factors were used for the purposes of this study: Emotional climate (4 items), Positive organizational leadership (4 items), and Innovation leadership (4 items). Participants respond on a Likert-type scale (1 = not applicable at all to 7 = very applicable. The overall reliability value was very satisfactory α = .92 [α = .87 positive and .89 innovation leadership].

Decision-making processes questionnaire [6]: Participants completed this instrument and shared flow (see in the next paragraph the description of shared flow scale) individually, immediately after finishing the creativity tasks. The questionnaire comprises 16 items and four dimensions [sharing information, generating alternatives, assessing alternatives and group cohesion] extracted from the key processes involved in decision-making. Responses are given on a 10-point Likert-type scale (0-9). The overall reliability value in this study was very satisfactory (α = .84).

Shared flow [4]: This scale contains 27 items and nine dimensions, spread across three factors: antecedents (balance between challenge and skill, clear proximal goals, unambiguous and direct feedback), process (merging of action and awareness, focused concentration on the current activity, sense of control over one's actions) and psychological effects (loss of self-consciousness, loss of time awareness or time acceleration, autotelic experience). Respondents answer on a 7-point Likert-type scale: 1 = totally disagree to 7 = totally agree. The reliability value of the scale in this study was very satisfactory (α = .92)

DESm, Differential scale of emotions by Izard, adapted by [8]: People had to answer about the emotions felt when performing the creative task. This scale proposes 20 items containing positive and negative adjectives to describe each emotion. It is answered with a Likert type scale where 0 = nothing to 4 = very much. The reliability of the scale for this study was very satisfactory α = .90 for positive emotions and α = .79 for negative emotions.

C. Data Analysis

Correlations between indicators of decision-making, flow, affect and organizational factors were carried out to examine some of the hypothesis. The Mediate procedure was used to estimate mediation [13]. Finally, SPSS mixed models were carried out to examine multilevel models analyzing the association between collective level and individual level predictors with outcomes.

D. The Experiment

Five-person groups or teams were formed, with a total of 61 teams (19 teams and n = 94 in T4). Creativity tasks had a first individual part, a second part individually and as a team, and a third part, only team. That is, in phase 1, the creative task was answered individually. Tasks posed a problem or dilemma and followed the same general response procedure. Phase two (individual and group) was conducted after participants had responded to FINO organizational and leadership scales. Finally, the last or phase 3 (properly group) was carried out after participants had assessed their own leadership style and that of their immediate superior. After performing individual

and as a group the creative task, participants answered individually three scales: decision making, affect and shared flow scales.

IV. Results

Correlations were carried out (using the total sample) between creative performance, decision-making process scores and the perceptions of organizational leadership and climate to examine H1. Group processes (sharing information, generation alternatives, evaluation and cohesion) correlated weighted mean $r = .18$, $p < .01$ with utility and efficacy of teams ideas – integrating with a meta-analysis correlations for different tasks and groups. In addition, climate, positive and innovation leadership were associated with this group decision-making process $r = .25$, positive affect felt during the performance of the creative task, $r = .12$ and shared flow, $r = .29$. The results revealed that positive organizational climate and leadership, organizational innovation correlate positively and significantly with three of the four decision-making process indicators (generation and assessment of alternatives and group cohesion), as well as with positive affect and shared flow.

TABLE I
Correlations between Decision Making, Positive Emotions and Shared Flow with Organizational and Leadership Variables

	Decision making					
	1	2	3	4	Pos.emot	Shared Flow
Climate	.04	**.27****	**.25****	**.18****	**.09+**	**.28****
Positive leaders.	.05	**.21****	**.15****	**.16****	**.11***	**.22****
Innovation leader	-.04	**.21****	**.36****	**.22****	**.09+**	**.22****

Leadership styles were associated with each other $r = .13$, $p < .01$, as were the different decision-making dimensions (min. = .14, $p < .007$ – max. = .78, $p < .001$). A multiple mediation analysis was carried out to examine H2 [9] using as dependent variable the utility and efficacy of individual proposals to team to solve the problem/dilemma in T4, decision making process as mediational variable and innovation organizational leadership as predictive variable. This analysis revealed a significant total coefficient value of .11 for perceived innovation leadership, trough group cohesion (see Fig. 1). Only Task 4 (19 groups and 92 subjects) show satisfactory intercorrelation indexes and this is why the others groups were excluded.

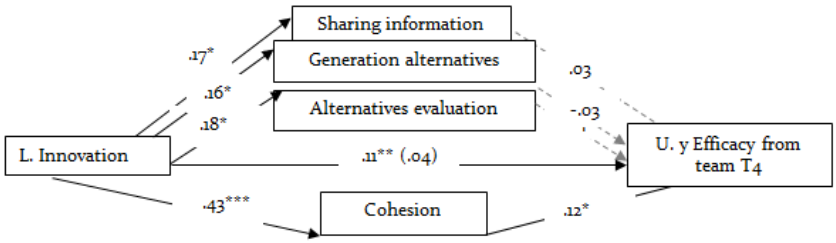

Fig. 1 Mediational model: utility and efficacy of individual proposals to team to solve the problem/dilemma in T4 regressed on decision-making process as mediational variables and innovation organizational leadership as predictive variable. Between (brackets) direct effect and total effect. ***$p < .0001$; *$p < .01$

A multilevel or hierarchical analysis was conducted to examine H3 using the SPSS MIXED procedure (version 22), applying the maximum likelihood estimation and a bootstrap sampling technique for 10,000 samples. The level 1 dependent variable was shared flow (individual scores). The level 2 predictor or explanatory variable was the group mean on Tran's scale (2004), which measures decision-making processes (see Fig. 2). The level 1 predictor variable was positive affect felt during the tasks (DESm scale). Independent variables were centred, i.e. the general mean was subtracted [10]. The level 2 unit of analysis was the working group ($k = 61$) and the level 1 unit was the sample outlined above ($n = 315$). The means, standard deviations and intercorrelations are presented in Table II.

TABLE II
Means, Standard Deviations and Intercorrelations between Variables

	M (SD)	1	2	3
1.-Shared flow	124.93 (24.21)	-		
2.-Positive affect	22.83 (9.43)	.41**	-	
3.-Group decision making	74.55 (10.72)	.40**	.21**	-

Due to space limitations, the different models are not presented (being these models: only with individual fixed effect, collective fixed, mixed fixed, with individual and collective random effects). Only is described the last mixed model with fixed and random effects, individual and collective and with cross level effect (the analyses are accessible in Internet in [11]). The final multilevel model includes random effects for level 1 and level 2 variables, as well as interactions between variables from different levels. This joint effect interaction between affectivity and the group mean for decision making indicates whether or not the relationship between affectivity scores and flow level changes when the group mean for decision making changes. The constant or intersection ($\check{Y}00 = 135.52$) is an estimation of the mean flow in the groups. If the t value is significant, this indicates that the group mean is different from 0. The mean for group decision making is positively and significantly associated with the degree of shared flow. In other words, for every point by which the group mean for decision-making increases, the group mean for shared flow increases by 0.78. This indicates a level 2 or collective effect between these two variables.

Positive affectivity scores are significantly associated with flow level. For every point by which positive affect increases, participants' flow increases by 0.97. Therefore, the mean slope for all groups is positive. The interaction effect between the group means for decision-making and positive affectivity was not found to be significant. The value of the coefficient was -.017. As stated earlier, as the group mean for decision making increases, so does the mean flow. What these results show is that changes in decision-making do not alter the slopes. This suggests that the relationship is very similar across the different groups. The variance of the residuals is very similar to that of simplest model, since the inclusion of group level variables does not contribute to reducing individual variability around the regression line of participants' respective groups. In other words, the inclusion of a group or collective variable does not affect individual variability.

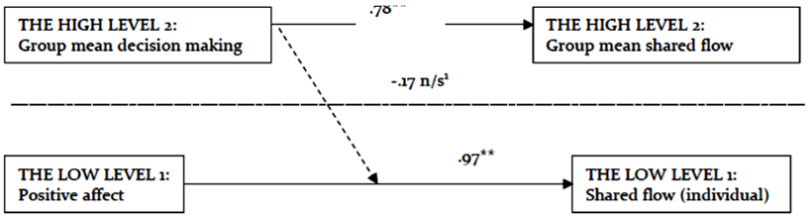

Fig. 2 Multilevel model. Observed individual, collective and interaction effects between decision-making, positive affect and shared flow.
[1]Interaction random coefficient significant (-4.43, p = .04). Random model is not better than fixed model

The variance of the means or intersections here (0 = 32.19) is notably lower than that observed in simpler model (0 = 119.96). The inclusion of the group covariate decision making reduces the variance between group means by 73%. In other words, after controlling for the effect attributable to individual affectivity scores in flow levels, the group covariate decision making explains this percentage of the difference between groups. The critical level associated with the Wald Z statistic was not significant here, which indicates that the mean variance across groups is no longer different from 0. Therefore, results seem to indicate that when the effect of group decision making and of individual affect are controlled for, the differences in collective flow across groups tend to disappear. The means seem to be associated with the slopes, which suggest that the intragroup relationship and level of shared flow decrease as the mean values drop, since the estimated value for covariance between means and slopes is -4.43. In order to gain a more direct view of this moderating effect, flow was correlated with positive affectivity in the group which scored below the mean for group processes, finding a correlation of .39, $p < .001$. The correlation between these same variables for participants whose groups scored above the mean was .31, $p < .001$. These results illustrate the aforementioned effect. However, it is also important to note that a Z comparison of the two correlations failed to find any statistically significant differences. Finally, the slope variance (1 = 0.61) was not different from 0. It is also important to note that the -2LL values for both this model and model that not include random slopes are practically identical.

V. Research Results and Conclusion

In relation to the first hypothesis, organizational climate, positive and innovation leadership were associated to decision-making group process, like generation and assessment of alternatives and group cohesion, as well as with positive affect felt during task and shared flow. These results confirm that the organizational context influences specific interactions, such as the performance of a creative task in a group. A benevolent or positive view of the organizational climate and leadership was associated to higher satisfaction with decision making group process, positive affect and shared flow felt during a specific creative task. Results suggest that the organizational context influences specific interactions. That is, a perception of greater innovation leadership and positive emotional climate in the organization positively influences the experience during the performance of team tasks, as well as the performance of these.

The usefulness and effectiveness of the creative response evaluated by judges was associated with satisfactory group decision-making - a result consistent with the second hypothesis. For its part, the sequential mediational model revealed that perceived organizational leadership (mostly innovation leadership) influenced a more positive assessment of the usefulness-efficacy of the contributions of the members to the group in T4. Perceived organizational leadership, which is conducive to creativity and innovation, influences the decision-making process and this in turn facilitates a more positive assessment of group's solution usefulness and efficacy, mainly through social cohesion.

In relation to the final hypothesis, the multilevel analysis revealed, as expected, that the more intense and satisfactory the group decision making, as a collective context, the greater the level of positive affectivity and shared flow. The model that was found to best fit the data indicates differences in the mean level of flow across groups, with a higher group mean for decision making corresponding to a higher group mean for shared flow or collective flow in this case, and a greater degree of individual positive affectivity corresponding to a greater degree of individual shared flow. Some results suggest that decision making may have a compensatory or mitigating effect, i.e. the more intense the group mean for this collective variable, the weaker the association between individual positive affectivity and flow. This was at odds with H3C that posit a synergy effect: in a satisfactory group decision-making context, flow would strongly related to affect. Although some

results support the compensatory profile, the model that includes these random cross level effects was not found to have a better fit. The results suggest that the collective level of decision-making does not affect the association observed between individual variables, as we had hypothesized.

VI. Recommendations

This study confirms that creativity was associated with more satisfactory decision-making processes, suggesting that improvement in work team competence can enhance creativity. Positive organizational leadership styles were significantly associated with the decision-making process and, through cohesion, were indirectly associated with the usefulness and effectiveness assessed by judges of the solution to a creative task generated by the group. Building a positive general climate and increasing positive and innovative organizational leadership can act as a context affording successful instances of creative teamwork. Training in teamwork skills can also, by facilitating successful decision making, reinforce the possibility that the work experience will be lived as an optimal or challenging and rewarding experience. Positive climate and leadership, enhancing positive affect, can also fuel flow during work team and reinforce job satisfaction.

VII. Suggested Research

The study has certain limitations. Firstly, although the tasks had been used previously in training activities in diverse contexts, no studies were found in which these task had been used as an indicator of creative performance [11]. The tasks were adapted to this study with the help and collaboration of experts with extensive experience in the military context. In our case, the time allocated for teamwork was limited, while in other studies the groups were permitted to work together for several days [6]. Moreover, although people in this context often work together as a team as part of their training, on these occasions the groups were established randomly. Despite this, however, and even though 50% of participants claimed not to feel competent for teamwork, involvement in the group task was high and the results were found to be consistent. Finally, another limitation is the size of the sample group. Some guidelines suggest a minimum of 30 groups with at least 30 people in each [12]. Our sample group exceeded the threshold of $N = 200$, as well as n = 10 cases per variable and 5 or 10 observations per estimated parameter. The most complex model had eight parameters, meaning that the sample group was three times the minimum requirement of 80. Moreover, the bootstrap method was used with 10,000 observations. Given the 61 groups, this means that the figure is above the 50 required for a reliable estimation of covariance parameters [13]. Nevertheless, it is true that the n per group was small and this is an important limitation from a statistical perspective. Future research should use working groups or work teams that run for several weeks, which perform more relevant creative tasks and probably evaluate the leadership of facilitators who train participants in effective teamwork techniques and creativity and innovation.

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