INPUTS, PROCESSES AND THE USE OF GROUPWARE: KEYS TO UNDERSTAND RESULTS OF WORK GROUPS IN UNIVERSITY STUDENTS

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Abstract

The models of efficacy of work groups propose two mechanisms of action regarding the results of groups: direct effects of work groups’ resources (inputs) and indirect effects of these resources, acting on the results of groups through group processes. These models also highlight the mediator/moderator role of some variables of the organizational context, as for example the use of technologies to support the work of the group, namely groupware, among others. Results of groups include the perception of members about them (satisfaction with both the results and the group performance). As part of a teaching innovation project, two objectives were established. First, an intervention aimed to increase the use of groupware in practical exercises of work groups was designed, expecting its influence on the perception of results. This intervention provided information about the groupware and different resources to easily access to these types of technologies. Second, this work was aimed to analyse the role of different inputs and group processes on the perception of results achieved by work groups in practical exercises. The sample included 293 Psychology students from the University of Jaén (Spain). Participants completed several assessment instruments in two different moments (time 1 and time 2): before and after the implementation of the program and the fulfilment of practical exercises (10 weeks spacing). The final sample consisted of 247 students, who completed the two assessments. Regarding the first aim, along with the information about the use and frequency of groupware, it was also included the perception of the group members about the results of work group, which was assessed by self-report measures. By using different variance analyses, results showed that, after the intervention program, participants increased the length of use of groupware, although they did not increased the frequency of use. Otherwise, no significant data were found regarding the perception of results of the work group. With respect to the first objective, results indicate that the simple use of informative strategies could be enough to increase the use of technologies to support the work in groups, although this is not enough to explain the variations in the perception of results of groups. Regarding the second objective, and by using self-report measures, information about the inputs used and group processes (tasks design, group design, tasks development, individual attention and conflicts management) was evaluated. Given that the intervention designed did not influence the perception of results, the variable groupware was not included in the following analyses. A multiple linear regression analysis was performed, including as criterion variables the perception of results achieved by the groups in time 2. Furthermore, as predictor variables were included the perception of results obtained by the groups in time 1 (in the first step), the inputs and group processes in time 1 (in the second step), and the inputs and group processes in time 2 (in the third step). Results revealed that the inputs and groups processes in time 2 added an additional percentage of variance to explain the results perceived in time 2, in addition to the contribution of results perceived, inputs and group processes in time 1. These data highlight the importance of models of efficacy of work groups to understand the functioning and results of work groups within educational contexts.

Keywords: inputs, group processes, groupware, work groups.

# INTRODUCTION

Work groups have become a contemporary reality with a great significance in the current society1. Their relevance, both in work and educative contexts, has lead to the development of a research body, which is focused on the identification and analysis of the factors that contribute to the achievement of results within these work groups. Furthermore, the competences related to the work in groups, as well as the acquisition and development of these competences, is a strategic objective for the future research, due to the incorporation of professionals in work groups in different contexts, who will have to interact with people from different places and formation2.

Work groups requires the interdependency of their members in relation with the task they are doing, their actions are guided by their common aims and furthermore, and furthermore, they continuously use coordination and mutual adjustment mechanisms3. Different models explaining the achievement of results in work groups have been developed, and in this regard, multiple review papers have analysed their main characteristics4, 5, 6. Many of these models are grouped under the perspective “input-process-output”(IPO)7 that, although not without criticism, has become a consolidated approach to explain the results of work groups.

The IPO models propose a group of variables related to the composition, structure and processes within the groups that are determinant of the achievement of results. Thus, the inputs refer to the group resources, for example, team composition (specially knowledge and skills of the members), and also the group structure and task design. These variables act as facilitator or inhibitor elements for the achievement of results in work groups6.

Besides, group processes, potentially mediators in IPO models, represent a set of psychosocial mechanisms that act as a link between inputs or antecedents and results. On the one hand, processes have been traditionally grouped in tasks processes, which are related to the functions of the group members (generation of strategies, action planning, helping behaviours, sharing the workload, coordination and communication). On the other hand, processes have been grouped in relation processes, which refer to the interactions among the members, especially the levels of conflict and conflict management strategies8.

Finally, outcomes refer to work results, including both the production of the group, evaluated by means of specific indicators, and the results that contribute to the maintenance of the performance of the group, including the satisfaction of the members, the level of desire that members have to keep working together and the innovation9,10.

In general, research shows the positive effects of the antecedents on the group processes, and also the positive effects of the group processes on the achievement of group results11. However, there is an important variability in the magnitude of the relation between antecedents, processes and group results. For this reason, it has been proposed that such relation could be modulated for some variables. From the IPO models, it is proposed that organizational and situational factors influence the team structure as a whole and that they affect the rest of variables (inputs, processes and output). An interesting variable of the context in which the group implement the work is the communication system used to do the task. The increasing interest on this variable is due to the fact that the use of technologies for the work group it is becoming more common in the organizations. In this line, some studies have examined the incidence of the communication system on the processes and group results12,13.

Considering that in university contexts the group structure is one of the key methodological options for the acquisition of learning, it is interesting the analysis of the main elements and variables that contribute to the efficacy of work groups. Among these variables, the technologies of information are crucial. Regarding the technologies that are available to support the work in the group, the option of telematics procedures is denominated groupware14, also called “collaboration technology”15. Although there is a high variety of this type of technologies and there is a continuous development in this field, some examples are14,16: e-mail, audio conferencing, collaborative presentation software, conference room video-conferencing, desktop video conferencing, discussion database, document management software, electronic whiteboarding, group authoring, GDSS, group scheduling and calendaring, knowledge management systems, one-way bulletin boards (BBS), personal communication tools like laptop or mobile phone, among others.

With the aim to deep into the analysis of relevant variables in the explanation of work group results in university contexts, different objectives were stated as part of a teaching innovation project that was carried out between 2014 and 2016. The first goal was to develop and to apply an intervention program to increase the use of groupware in university students, analysing the effects of this program both on the length and frequency of use of groupware and on the group results (concretely, the perception of results by the group members). The second goal was to analyse the role of different inputs and group processes on the perception of results achieved by work groups in practical exercises.

# MEthodology

## Participants

As part of a teaching innovation project, students of third and fourth course of the Psychology Degree of the University of Jaén (Spain) were offered to be participants of an intervention program. A total of 293 students completed several assessment instruments in two different moments (time 1 and time 2). The final sample consisted of 247 students, who completed the two assessments (*M*age = 22.06, *SD* = 3.38; 19.9% males, 80.1% females).

## Instruments

An *ad hoc* instrument to assess factors associated to the functioning of work groups was used17. It includes three scales: “antecedents”, “processes” and “results”, with a total of 23 items with a likert scale (1 = totally disagree; 5= totally agree). The first scale (antecedents) assesses the factor “task and group design” (6 items, alpha coefficient = .80). The second scale (processes) assesses the factors “tasks development” (5 items) and “individual attention and conflict management” (4 items), with alpha coefficient = .90. The third scale (results) assesses the factors “production and satisfaction” (4 items) and “group atmosphere” (3 items), with alpha coefficient = .94. Regarding the scale “results, in the current study the items related to the factor “production and satisfaction” were used.

Other aspects related to the use of groupware were also evaluated: instant messaging, video calls, email, phone calls, graphs and text presentations, information from databases, repositories and teaching platforms, instruments and communication apps to contact with relevant persons to carry out the work, instruments and apps to do the work within the group (e.g. projects managements, agenda creation, decision making, etc.). Concretely, the average length of daily use of technologies for the work group and the average frequency of daily use were evaluated. In case of positive answers about the use of these technologies, participants were asked to indicated, for each type of technology, the average length of daily use with a likert scale (1= occasionally, 2= less than 30 minutes, 3= between 30 minutes and 1 hour, 4= between 1 and 2 hours, 5= between 2 and three hours, 6= between 3 and 4 hours, 7= more than 4 hours). Participants were also asked to respond about the average frequency of daily use by using a likert scale (1= occasionally, 2= once in a day, 3= between 2 and four times, 4=between 4 and 6 times, 5= between 6 and 8 times, 6=, between 8 and 10 times, = more than 10 times).

## Procedure

Participants completed voluntarily, in their classrooms, the aforementioned assessment instruments, under the supervision of the university teachers implied in the teaching innovation project. The assessment was carried out in two different moments (time 1 and 2, 10 weeks spacing).

Between time 1 and 2, the intervention program was applied in the classrooms. This program consisted of an informative lecture about different technologies that students could use for their work in groups, as well as the advantages of the use of these types of technologies. For these lectures, teachers used slides presentations containing all the information provided to the students. Then, these presentations were available for the students in the virtual teaching platform of the University of Jaén (Spain). The informative lectures and the slides presentations was elaborated on the basis of the work about the use of new technologies in work groups by McGrath y Hollingshead (1994).

## Statistical Analyses

Descriptive statistics (Mean and Standard Deviation) for the variables of the study were calculated. Besides, to explore the relations among the variables a Pearson product-moment correlation analysis with the significance level associated was used, including all the variables and the two assessments (time 1 and 2). To examine the possible effect of the intervention program (applied between time 1 and 2) on the length and frequency of the use of groupware in work groups, and also on the group results, the differences among the means of these variables in time 1 and 2 was analysed, by using different ANOVAs. Finally, to explore the role of the antecedents and group processes on the work group results in time 2, and to analyse the percentage of variance explained by the predictor variables, a lineal multiple regression analysis was made. All the statistical analyses were performed with the Statistical Package for the Social Sciences (SPSS) v. 20.0.

# RESULTS

Regarding the descriptive statistics, means and standard deviations of the variables are presented in Table 1.

Table 1. Means and standard deviations of the variables of the study

|  |  |  |
| --- | --- | --- |
| Variables | Mean (SD)  Time 1 | Mean (SD)  Time 2 |
| Tasks and group design | 3.04 (0.60) | 2.94 (0.66) |
| Tasks development | 3.18 (0.73) | 3.08 (0.81) |
| Individual attention and conflict management | 3.17 (0.58) | 3.15 (0.63) |
| Production and satisfaction | 3.29 (0.74) | 3.16 (0.84) |
| Average length of daily use of groupware | 2.53 (0.88) | 2.71 (1.02) |
| Average frequency of daily use of groupware | 2.29 (0.92) | 2.44 (0.98) |

With regard to the relations between variables, Pearson correlations coefficients are presented in Table 2.

Table 2. Correlations between the variables of the study

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 1. Tasks and group design (t1) | -- |  |  |  |  |  |  |  |  |  |  |
| 2. Tasks development (t1) | .69\*\* | -- |  |  |  |  |  |  |  |  |  |
| 3.Ind. attention/conflict manag.( t1) | .61\*\* | .62\*\* | -- |  |  |  |  |  |  |  |  |
| 4. Production and satisfaction (t1) | .65\*\* | .82\*\* | .58\*\* | -- |  |  |  |  |  |  |  |
| 5. Average length of groupware (t1) | .08 | .02 | .05 | .01 | -- |  |  |  |  |  |  |
| 6. Average freq. of groupware (t1) | .10 | .00 | .03 | -.00 | .68\*\* | -- |  |  |  |  |  |
| 7. Tasks and group design (t2) | .61\*\* | .50\*\* | .46\*\* | .50\*\* | .06 | .10 | -- |  |  |  |  |
| 8. Tasks development (t2) | .54\*\* | .60\*\* | .47\*\* | .59\*\* | .02 | .02 | .81\*\* | -- |  |  |  |
| 9. Ind. attention/ conflict manag.( t2) | .51\*\* | .46\*\* | .47\*\* | .41\*\* | .02 | .04 | .78\*\* | .75\*\* | -- |  |  |
| 10. Production and satisfaction (t2) | .50\*\* | .53\*\* | .37\*\* | .59\*\* | .00 | .02 | .79\*\* | .90\*\* | .72\*\* | -- |  |
| 11.Average length of groupware (t2) | .10 | .03 | .09 | .06 | .52\*\* | .49\*\* | .11 | .11 | .09 | .09 | -- |
| 12.Average freq. of groupware (t2) | .08 | .02 | .08 | .02 | .43\*\* | .51\*\* | .08 | .04 | .06 | .04 | .76\*\* |

*Note.* \*\* *p* < .01

Separated analysis of the two assessments (time 1 and 2) show positive and significant correlations between antecedents (task and group design) and group processes (task development and individual attention and conflict management). In time 1, results (production and satisfaction) are also correlated to task and group design (antecedents) (*r* = .65; *p* < .01); and to task development (*r* = .82; *p* < .01) and to individual attention and conflict management (group processes) (*r* = .58; *p* < .01).

In time 2, production and satisfaction (results) is positive and significant correlated to task and group design in time 2 (*r* = .79; *p* < .01), to task development (*r* = .90; *p* < .01) and to individual attention and conflict management (*r* = .72; *p* < .01).

When variables are analysed together in time 1 and 2, results (production and satisfaction) in time 2 is positive and significantly correlated to task and group design in time 1 (*r* = .50; *p* < .01), and to task development (*r* = .53; *p* < .01) and individual attention and conflict management (*r* = .37; *p* < .01). The variables regarding the average of length and frequency of daily use of groupware are only positive and significantly correlated each other.

To examine the possible effect of the intervention program on the length and frequency of use of technologies, and also on the group results (production and satisfaction), the means of these variables were compared in time 1 and 2 by performing different ANOVAs. Data show that there is a significant effect of the intervention program on the average length of daily use of groupware *F*(1,491) = 4.844; *p* = .028; η2p= .01, but not on the average frequency of daily use of groupware *F*(1,491) = 3.015; *p* = .083; η2p=.006. Concretely, after the intervention program, participants significantly increased the average length of use of groupware to carry out the work in their group. Otherwise, the intervention program had no effect on the group results (production and satisfaction) *F*(1,491) = 3.623; *p* = .058; η2p= .007).

A multiple lineal regression analysis was used, including as a criterion the variable results (production and satisfaction) in time 2, and entering different predictor variables in blocks. The variable results (production and satisfaction) in time 1 was entered at Step 1 to control its possible effect on the criterion variable. Then, antecedent variables (task and group design) and group processes (task development and individual attention and conflict management) in time 1 were entered at Step 2. Finally, antecedent variables (task and group design) and group processes (task development and individual attention and conflict management) in time 2 were entered in Step 3. Due to the null effect of the intervention program on the group results, it was decided not to enter any variable related to the use of groupware in the regression analysis. The data of the analysis are shown in Table 3.

Table 3. Hierarchical regression analysis for the predictor variables of results (production and satisfaction) in time 2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | β | t | R2 | ∆R | Change in F |
| Step 1 |  |  | .341 | .341\*\*\* | 127.954 |
| Production and satisfaction (t1) | .587 | 11.312\*\*\* |  |  |  |
| Step 2 |  |  | .361 | .028\* | 3.562 |
| Task and group design (t1) | .205 | 2.724\*\* |  |  |  |
| Task development (t1) | .084 | 0.871 |  |  |  |
| Individual at. and conflict manag. (t1) | -.048 | -0.700 |  |  |  |
| Step 3 |  |  | .835 | .468\*\*\* | 231.547 |
| Task and group design (t2) | .145 | -2.731\*\* |  |  |  |
| Task development (t2) | .686 | 13.112\*\*\* |  |  |  |
| Individual at. and conflict manag (t2) | .116 | 2.543\* |  |  |  |

*Note*. \* *p* < .05; \*\* *p* < .01; \*\*\* *p* < .001

In the Step 1, production and satisfaction (results) in time 1 was entered. This block was significant *F*(1,244) = 127.954; *p* = .000, explaining the 34% of the variance in production and satisfaction in time 2. The relation between the two variables was positive (*β* = .587; *p* = .000). At the Step 2, with the inclusion of the block of antecedents (task development and individual attention and conflict management) in time 1, there is a significant increase of the explained variance in 2%, *F*(4,241) = 35.667, *p* = .000, reaching a 36% of variance. Thus, results in time 2 are explained by antecedents (task and group design) β = .205; *p* = .007, along with results in time 1. The relation between these variables is positive. At the Step 3, the block including antecedents (tasks and group design) and group processes (task development and individual attention and conflict management) in time 2, was also significant, *F*(7,238) = 178.107; *p* = .000, explaining the 83% of variance in results in time 2 (47% of additional variance). Apart from the relations with the variables in block 1 and 2, results in time 2 were positive and significantly related to antecedents (*β* = .145; *p* = .007), task development (*β* = .686; *p* = .000) and to individual attention and conflict management (*β* = .323; *p* = .000) in time 2. Similarly, there was a negative relation to the antecedents in time 2 (*β* = .116; *p* = .012).

# CONCLUSIONS

On the one hand, the first aim of the current study was to analyze the effect of an intervention program to increase the use of groupware. Data revealed that the intervention program increased in a significant way the average length of daily use of technologies to carry out the work in the group. Thus, these data show the effectiveness of a brief intervention based on divulgative information. However, the intervention did not influence the frequency of daily use of technologies. Thus, it could be interesting in future studies to include some additional variables according to the Technology Acceptance Model, which indicate that there are some variables that affect the intention of use of new technologies in general, and particularly, of groupware, as for example the accessibility of use of these technologies and the perceived utility 18.

On the other hand, the application of the intervention program did not have any significant effect on the results of the work group, to be precise, regarding the members’ perception about production and satisfaction. Some authors have noted that the influence of technologies on processes and group results depend on the type of task20. Furthermore, there could be included other indicators of group results on which it can be some effect of the use of groupware.

The second objective of this paper was to examine the role of different inputs and group processes in the perception of results achieved by work groups. Data indicated that these results of the work group are mainly explained by the group processes during the implementation of the task, along with the antecedents (those aspects related to the design of the task and the work group) (47% of the variance), the results previously achieved in other works in group (34% of the variance) and, in a lesser extend (2% of the variance), the antecedents associated to other previous works that were made by the group. Consequently, the best predictors of the group results are the factors indicated in the models of efficacy IPO7, such as the antecedents and group processes generated during and to the implementation of the work, followed by the previous results achieved in other work in groups.

In future studies, on the basis of the criticism to the stasis of the models IPO21, and considering that these models did not include the process aspects, it could be interesting to include the perception of the group members about reflexive actions (team debrief session) once they finish the group tasks. These types of sessions have been effective in the achievement of results19.

To conclude, the current study has yielded relevant information about those elements and variables that contribute to the efficacy of work groups. Nevertheless, further research on the differential processes and group results related to the use of technologies is needed.

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