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The Effects of Team Flow on Performance: A Video Game Experiment

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ABSTRACT

Research on effective team work has traditionally explained team performance as a result of team cohesion and goal commitment. Team cohesion was originally defined as the general level of attraction the team members had to all others in their group. This social relations-based concept of team cohesion is generally a strong indicator of team performance. However, more recent research has stressed the importance of incorporating the team members' mutual level of commitment to the team task as another sub-dimension of cohesion. When including task commitment, team cohesion is a somewhat weaker predictor of team performance (Beal et al., 2003). To better conceptualize the role of the task engagement and to explain team performance, we incorporate a variable more relevant to the characteristics of a team task: team flow. The concept of "flow" has been well researched and theorized at the individual level. However, in an experiment based on collaborative video gaming, we demonstrate that not only can flow be extended to the team level to better explain performance, but that teams can quickly generate a psychological flow state from low cost treatments like collaborative video gaming which can also be effectively transferred into subsequent work tasks.

Keywords

Team flow, team performance, team cohesion, collaborative video gaming.

INTRODUCTION

Organizational tasks and problems are increasingly complex, requiring carefully coordinated team effort to achieve performance goals. Accordingly, organizations are searching for new and effective ways to improve team performance in order to handle the rising complexity of business and organizational problems. Fortunately, evolution in education, societal norms, and work environments over the past century have led to greater individual capacity for cooperative team behavior. Nevertheless, as organizations are increasingly structuring

work around teams, the need to make individuals more productive through effective teamwork remains a critical area for research.

Team performance is typically explained as a function of team cohesion and goal commitment (Festinger et al., 1950). At a high level, team cohesion refers to the unity and bond that forms when team members have mutual positive feelings toward each other (Festinger et al., 1950) and a strong commitment to the task (Carless and De Paola, 2000). Therefore, companies spend upwards of \$1 billion (USD) annually, just in the United States, on team building activities designed to increase cohesion.

Existing research has revealed mixed results about the relationship between team cohesion and performance. In particular, when team cohesion is defined solely by the interpersonal attraction among the group, there is a strong relationship with performance. However, when task commitment is included in group cohesion, the relationship with performance weakens (Beal et al., 2003). Consider the context of sports. There is a greater element of enjoyment. There is strong time pressure. The team members are fully immersed. These variables are determined by the nature of the task—which is not *directly* accounted for by the team cohesion construct. Similarly, many small work teams are newly formed and have time-critical tasks. In these cases, teams have not had a chance to develop cohesion.

To improve our understanding of team performance, we incorporate the concept of "flow" which refers to the psychological state of being total immersed in, and focused on, a task (Admiraal et al., 2011; Lowry et al., 2013a). In this study, we develop a new "*team flow*" construct as our primary theoretical contributions to explain team performance. As a further contribution, we also test whether newly formed work teams in time-sensitive situations can be encouraged to develop team flow on work tasks by beginning with a team building activity specifically designed to encourage a state of team flow. In particular, we employed collaborative video gaming as a team flow treatment and compare it to a more traditional goal training treatment and a control (no treatment). Because it is much lower-cost and less time-

intensive than traditional team building activities like ropes courses, the practical implications are significant for organizations investing in their teams.

To explore team flow and observe its effects on team performance, we employed a laboratory experiment in which we manipulated several team interventions (including video gaming) designed to build team flow. Our results reveal that team flow is a stronger explanation of team performance than team cohesion in the context of newly formed work teams in time-sensitive tasks. In addition, 45-60 minutes of playing collaborative video games can improve team performance by roughly 20 percent over goal training alone.

TEAM FLOW

Flow is composed of several important sub-dimensions including a sense of control, intense concentration, loss of self-consciousness, time distortion, and merging of action and awareness (Csikszentmihalyi, 1990). In video games and other similar intrinsically motivated contexts, individuals form a temporary affect-based attachment to a “virtual” environment that seems increasingly real as flow deepens (Jennett et al., 2008; Lowry et al., 2013a).

Although not originally developed with information systems in mind, flow has been applied extensively within information systems research (Lowry et al., 2013b). In IS research, Flow has been operationalized as Cognitive Absorption (CA) (Agarwal and Karahanna, 2000). Cognitive absorption leverages flow as its conceptual foundation because manifestations of flow include control, curiosity, heightened enjoyment, time distortion, and focused immersion (Agarwal and Karahanna, 2000)—thus mirroring the dimensions of CA. When flow is activated, individuals experience a psychologically detached state during which stimuli outside the current focus of attention are completely ignored.

By and large, flow has been applied to the individual unit of analysis, rather than to teams. While CA works well as an operationalization for individual flow, team flow cannot be achieved without some degree of communication (both verbal and non-verbal). For example, a team member will not become immersed on a task in which he or she depends on another member if they do not communicate effectively. They will not feel in control of their situation if they cannot coordinate with others on whom they depend. They will not enjoy their task or lose track of time if they are stuck on a problem or task which depends on help from another. Thus, we add communication as a sixth dimension of team flow.

In summary, team flow occurs when a team is able to become completely immersed in an interdependent task that members are intrinsically gratified together. Team flow enhances our understanding of team performance in contexts of newly formed work teams because while cohesion is determined by team members evaluations of each other (i.e. pride, unity, and social relations), team

flow is affected by nature of the task itself (i.e. enjoyment, time dissociation, control, curiosity, immersion, communication). As a result, team flow may be able to form in situations where team cohesion may not because of personality conflicts. Likewise, if team cohesion takes greater time to develop because of team member inhibitions or other reasons, team flow may form sooner since work on the task begins immediately.

Hypotheses

To be clear, the core of our theoretical model is based on the literature proposing team performance as a function of goal commitment and team cohesion (Klein et al., 1999). We extend this theory to include team flow.

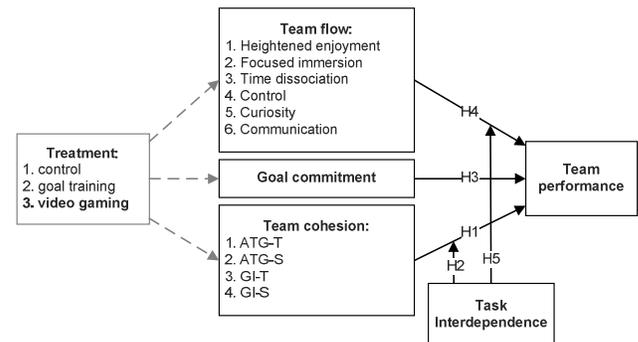


Figure 1. Theoretical Model

As discussed above, group cohesion in work teams has two aspects: task cohesion and social cohesion (Carless and De Paola, 2000). Task cohesion refers to whether team members like the way the team is working together towards a task in terms of the team’s desire to perform the task, the approach the team takes towards the task, and whether the individual feels the team allows them to participate and contribute towards achieving the team’s goal. Social cohesion pertains to whether the person seeks and enjoys social interaction with team members. Meta-analyses have consistently found a significant relationship between both types of cohesion and group performance. For example, Evans and Dion (2012) found cohesive teams are more productive than non-cohesive teams. Cohesion increases team performance because when teams are cohesive, they do not exhibit traditional barriers to task accomplishment, such as miscommunication, member misbehavior (e.g., free-riders), and competitive goals (Tjosvold et al., 2004), thus paving a smoother path toward goal accomplishment.

Task interdependence has been found to moderate the relationship between group cohesion and performance (Beal et al., 2003). Tasks that require group members to be interdependent include concurrent and sequential work that requires cooperation, communication, and coordination. In groups with high task interdependence, a stronger correlation has been found between cohesion and performance than in groups with low task interdependence (Beal et al., 2003). Some tasks, such as performing surgery or playing a game of basketball

require high levels of interaction among group members. Conversely, some so-called group tasks such as golf and bowling are often done in groups but are essentially non-interdependent tasks, where an individual largely knows what to do and does it and there is little need for the group to coordinate, communicate and cooperate.

Beal et al. (2003) found that group cohesion has a positive correlation with group effectiveness ($\rho = .18$) and a stronger relationship with group efficiency ($\rho = .31$). Cohesion provides a benefit when efficiency is important because cohesive groups communicate clearly, quickly, and coordinate their actions. When such group efficiency occurs in an environment that rewards it (i.e., for interdependent tasks), cohesive groups have an advantage. Thus, team cohesion, in an interdependent task context improves team performance.

H1. Team Cohesion Has a Positive Effect on Performance.

H2. Team Interdependence Moderates the Effect of Cohesion on Performance

Goals are a pervasive construct used across a variety of theories including goal theory (Locke and Latham, 1990) and social cognitive theory (Bandura, 1991) to explain self-regulation and motivation (Klein et al., 1999). Increasing goal commitment has been linked to improved team performance across a variety of settings (Klein et al., 1999; Klein and Mulvey, 1995). Goal commitment improves performance by focusing the team on the outcome of their interactions, thus accelerating their actions toward a united goal (Klein et al., 1999; Klein and Mulvey, 1995). When compared to a team with competitive or individual goals, the team committed to cooperative goals will exhibit greater performance (Tjosvold et al., 2004).

H3. Goal Commitment Has a Positive Effect on Performance.

We hypothesize a positive relationship between team flow and performance. Such a relationship has been observed previously by Admiraal et al. (2011), also in a collaborative and competitive team video-gaming context. However, Admiraal et al. (2011) assessed flow in terms of qualitative observations of team engagement and interest. As we are operationalizing flow as a quantitative assessment of communication and CA, our approach is sufficiently distinct to necessitate additional theorizing. As communication within the team improves, performance should improve because communication facilitates shared vision and goal alignment (Mathieu et al., 2000) within the team. As communication facilitates shared mental models, teams become more reflexive (able to adapt to the unexpected) and more streamlined in their task processing and team interactions (Mathieu et al., 2014). These, in turn, drive greater performance (Mathieu et al., 2014; Mathieu et al., 2000).

As cognitive absorption within the team increases, performance should increase because CA represents deep engagement and focus on the task at hand (Agarwal and Karahanna, 2000), specifically in terms of control, temporal dissociation, heightened enjoyment, focused immersion, and curiosity. Of all the effects in the original CA model (Agarwal and Karahanna, 2000), the effect between CA and perceived ease of use was the strongest. Such a finding suggests that when we experience CA, we perceive the task at hand to be less difficult than otherwise. Such an effect is observed because when we are immersed, we ignore external (distracting) stimuli that may divert our attention from our tasks – this is due to an increased sense of curiosity which focuses our attention on only stimuli relevant to our current pursuit (Lowry et al., 2013b). Taken together, an increase in communication and an increase in CA (i.e., an increase in team flow) should improve team performance.

Based on similar reasoning to H2, we also expect task interdependence to moderate the effect of team flow on performance. Tasks that require group members to be interdependent must have greater communication—a key component of our team flow construct—in order to be successful (Beal et al., 2003). Interdependence will reinforce team-member engagement, thus strengthening the effect of team flow on performance by increasing the intensity of the flow experience.

H4. Team Flow Has a Positive Effect on Performance.

H5. Team Interdependence Moderates the Effect of Team Flow on Performance

METHODOLOGY

To test our theoretical model, we designed a laboratory experiment with three randomized treatments: 1) control – no treatment, 2) goal training, and 3) video games. Participants were solicited from the business school of a large private university in the western United States. The participants were enrolled in a variety of different courses whose instructors participate in a shared research laboratory and offer their students extra credit for participating in any of the studies administered through the shared lab. A total of 352 participants completed all procedures. Of those who chose to report gender, 21 percent were female.

Tools, Task, and Procedures

Task 1: Establishing Baseline Team Performance

Our sample consisted of 80 teams. After being assigned to groups, the Findamine app was installed on two (and only two) of the smartphones belonging to each team. Six clues (all located around the immediate campus) were downloaded into the app on each device (the same six clues for each phone and each team). They were allowed a total of 25 minutes to find as many clues as fast as possible. Their total score would be the combined total of

the points on both phones. Each team was tasked to earn the highest score possible. Upon returning, each team was shown their standing on the leaderboard and each member was asked to complete a survey measuring the constructs in this study (team flow, team cohesion, etc.).

Team Intervention: Treatment

Upon completing Task 1, each pair of teams was randomly (but equally) assigned to one of three treatments: 1) control, 2) goal training, or 3) collaborative video gaming. Those assigned to the control condition were asked to spend the next 30-60 minutes individually working on homework. Team members were instructed to not speak with each other until Task 2 began. Those in the goal training condition were given a “traditional” corporate goal training seminar. The team was then given a worksheet which required them to specify a measurable, objective, and achievable goal (in terms of the score they wanted to earn in the next round of Findamine). The worksheet also required them to outline the strategies and steps they would take to achieve that goal.

Lastly, those in the collaborative video gaming treatment were allowed to democratically choose between playing Rock Band™ or Halo 4™. Although this prevents us from examining the causality of video game type, this tradeoff was deemed acceptable because it allowed team members to play the game they found most interesting and engaging to their preferences. Those in the Rock Band condition were tasked to earn the highest possible score across any four songs of their choosing. Those in the Halo 4 condition played three rounds of the team-based “capture the flag” sub-game against the other team in their cohort. The goal training and video gaming treatments also lasted between 30-60 minutes.

Task 2: Measuring Change in Team Performance

After the treatment, participants were given another short survey to measure their goal commitment before the last round of Findamine. Once again, the teams had 25 minutes to complete as many (new) clues as possible. Upon finishing this task, the teams returned to see their combined score and standing on the Task 2 leaderboard and completed another survey measuring all variables.

RESULTS

Measurement Model

Pre-analysis was performed to test the convergent and discriminant validity of the reflective sub-construct measures, test for multicollinearity, ensure reliabilities, and check for common methods bias (CMB). The results indicated acceptable factorial validity and minimal multicollinearity or CMB.

Hypothesis Testing

Figure 3 visualizes the path coefficients for the PLS model. The t-statistics were generated from running 1000 bootstrap procedures. The β coefficients on the dotted paths from Treatment (measured as a set of dummy codes) to Flow, Commitment, and Cohesion represent the effects of three treatments (control, goal setting, video gaming) on the exogenous independent variables in our team flow theory.

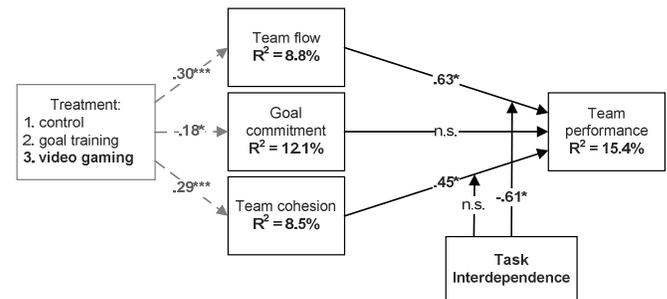


Figure 3. Path Coefficients and Bootstrap Results

Most of our hypotheses were supported. Team cohesion had a significant positive effect on team performance ($\beta = 0.45$, $p < 0.05$), thus supporting H1. Team flow also had a significant positive effect on team performance ($\beta = 0.63$, $p < 0.05$) supporting H4. However, goal commitment did not have a significant effect in our model after accounting for team flow and cohesion. Nevertheless, a test of goal commitment before including the other exogenous variables demonstrated a significant positive effect ($\beta = 0.15$, $p < 0.05$). Clearly though, the effect of goal commitment is better captured by the separate effects of flow and cohesion. Additionally, CVG appears to be a valid treatment for improving both team flow ($\beta = 0.30$, $p < 0.001$) and team cohesion ($\beta = 0.29$, $p < 0.001$). Lastly, interdependence produced some unexpected findings. While it did not interact with team cohesion to a significant level, we found that interdependence actually reduced the effect of team flow on task performance ($\beta = 0.61$, $p < 0.05$) – counter to our hypothesis. Another interpretation of this finding is that flow and interdependence are tradeoffs which do not coexist well, yet both enhance task performance (as indicated by a post-hoc test, the direct effect of interdependence on performance: $\beta = 0.18$, $p < 0.01$). This dampening effect may indicate the extra required effort and time for interdependent, non-parallel tasks.

DISCUSSION

Through this study, we have established that flow is a construct that can be conceptually mapped to the team level and is a significant predictor of team performance. If the 20% improvement we discovered remains consistent across contexts, then any team task requiring five hours of work or more would conceivably benefit by first playing 60 minutes of collaborative video games. This would be particularly useful for organizations without the time or

money to spend putting employees through other costly team-building activities.

From a theory-building perspective, the development of team flow as a new construct offers a useful new tool for organizational theorists seeking to capture the extent to which team members are able to work effectively in concert based on latent cues. Application of this new construct into new domains and new populations will be critical to vetting its usefulness and generalizability. In addition, team flow may be used to explain certain contexts where traditional indicators of team performance have low predictive power. For example, our context was newly formed work teams with time-sensitive tasks.

Another implication of our findings is that there are positive outcomes of video gaming. Figure 4 indicates an approximately 20% performance improvement for the collaborative video gaming treatment and almost no effect of the goal training treatment. A repeated measures ANOVA analysis shows a clear effect of treatment ($F = 5.282$, $p = 0.007$) with no difference between team sizes of three and four. A priori power analysis conducted with G*Power resulted in power of .95 for our sample size, which is well above the .80 threshold recommended by Cohen (1988).



Figure 4. Team Performance over Time

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