Shared Flow Measurement in IT Teams: An Inductive Approach for Emergent Attributes

Full Paper

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Abstract

Drawing on Flow Theory (Csikszentmihalyi, 1990), this study empirically identifies attributes that emerge in the relationship among information technology (IT) team members at work, and it also proposes and validates a scale (Vibe-IT) for measuring shared flow in IT teams. At the theoretical level, this study seeks to fill a gap identified in the literature regarding shared flow measurement. At the managerial level, the outcomes suggest that recognizing and valuing vibrant professionals may prove to be a good practice for team management.

Keywords

Shared flow, IT teams, IT professionals, IT management.

Introduction

Research on individual performance investigates individuals' intrinsic and extrinsic factors that facilitate or constrain task effectiveness. When tasks are performed by a team, performance is not simply the sum of the members' individual performances (Crown & Rosse, 1995), what signals to an important research opportunity on the factors that affect team performance.

The performance of teams and, in particular, IT teams, has been treated under different and complementary perspectives, like the theories of positive psychology (Demerouti et al., 2012), mainly the motivational ones (Ryan & Deci, 2000), organizational theory (Crown & Rosse, 1995), software engineering (Siau et al., 2010), the socio-technical perspective applied to the management of IT teams (Bellini et al., 2012), and the collective emotions and affect, such as the motivational aspects in teams (Park et al., 2013). Nevertheless, some individuals seem to be able to act toward important results regardless of the environment or any other factor that facilitates or constrains their actions. That drive for personal excellence seems to be caused by extrinsic conditions (e.g., the organizational structures or social expectations) and intrinsic conditions (e.g., values, skills, or competencies). If motivated, the individual moves toward the goal so that enablers and constraints are of secondary importance. Flow theory (Csikszentmihalyi, 1990) explains human motivation according to a set of factors that characterize the individual autotelic experience (self-rewarding) which in turn promotes a high degree of personal engagement in relation to a task – the "state of flow".

Flow as subjective experience has been widely investigated at the individual level. Nevertheless, shared flow, that is, the shared experience of flow by members of a team, is a relatively unexplored topic when it comes to the collective experience of flow (Heyne et al., 2011; Nakamura & Csikszentmihalyi, 2005), thus fostering research on flow in teams and social integration (Engeser, 2012, p. 18). This article aims to identify which cognitive and behavioral attributes emerge from the relationship between individuals in shared flow, given that (a) the management of IT teams and performance is current in the literature (Bellini et al., 2012), (b) there is demand for research on the motivational aspects that foster team outcomes (Engeser, 2012; Heyne et al., 2011; Nakamura & Csikszentmihalyi, 2005), and (c) teams acting under flow would be a mitigating condition of efforts involved in "a" and contribute to "b" to identify factors that promote motivation and job satisfaction in teams.

Traditionally, flow measurement in work teams has focused on the individuals and their perceptions about themselves, according to the nine original dimensions of flow. We nevertheless adopt a different rationale, which is inductive about the attributes that emerge in the relationship among members of a team during their action. We believe that complementary dimensions of shared flow – identified by an inductive approach (Swann et al., 2012) – contribute to the literature on flow measurement.

We focus on software development teams in particular, considering that they have characteristics of autotelic experience as antecedents of performance. Software development requires iteration and interactivity between team members, thus tending to reach better outcomes by means of established bonds between individuals and subgroups (Sawyer, 2003).

Theoretical background

Flow theory (Csikszentmihalyi, 1990) explains human motivation from a set of factors that promote the achievement of a high degree of personal engagement in relation to the tasks – the *state of flow*, or just *flow*. Flow relies on the balance between the environmental opportunities for action (characterized as challenge) and the personal skills, and also on the fact that such a balance is constantly shaken by the increasing complexity of the challenge (Csikszentmihalyi & Massimini, 1985), a sort of challenge-skills spiral.

There are enabling conditions to reach flow: (1) the establishment of tasks with the possibility of reaching the goal (the balance between challenge and skills), (2) the definition of clear goals, (3) immediate feedback, and (4) the sense of action control. There are also properties that occur during flow: (5) deep participation that leads to automation and spontaneity (fusion between action and consciousness), (6) deep involvement that removes frustrations and everyday concerns from the conscience, (7) loss of self-consciousness, (8) changes in the perception of time, and (9) autotelic experience, comprising nine dimensions of flow (Csikszentmihalyi, 1990; Engeser, 2012).

Flow is directly related to the influence of other individuals and external structures (Csikszentmihalyi & Hunter, 2003). In social contexts, the occurrence of flow in an individual tends to be perceived by others, what causes "contagion" – a natural mimetic process – that can lead others to experience flow collectively (Aubé et al., 2014; Engeser & Schiepe-Tiska, 2012). There are specific conscious and unconscious characteristics occurring at the social level of flow, which are based on cognitive processes (e.g., Pineau et al., 2014), behavioral aspects (e.g., Swann et al., 2012), and emotional contagion theory and affective-motivational shared states (e.g., Salanova et al., 2014). These characteristics can be cognitive ("people are able to recall a similar situation") as well behavioral and emotional ("and so express a similar affective state") (Salanova et al., 2014, p. 438).

There are indications that the most memorable experiences of flow (in the sense of perceived satisfaction and joy) occur during intense social interactions (Walker, 2010). Shared flow, therefore, is a collective state occurring at the peak of individual abilities (Sawyer, 2003) which involves interdependency between individuals during co-active and interactive tasks (Walker, 2010).

There is an extensive literature dealing with flow and the positive aspects of such experience, both at the individual and the team levels, and especially about teams in sports, arts, and learning (Lee, 2009; Pineau et al., 2014; Ryu & Parsons, 2012; Sawyer, 2003; Swann et al., 2012; Walker, 2010). On the other hand, the literature on flow in work teams is sparse (Heyne et al., 2011). In work activities, there is evidence that individuals who achieve (or experience) flow are more efficient than those who do not (Csikszentmihalyi, 1990). Outstanding performance is attributed to the experience itself, which stimulates the search for better outcomes and the satisfaction that the outcomes promote, which in turn feeds back the process again (Engeser & Rheinberg, 2008).

The first known mention to flow measurement is attributed to the experience-sampling method (ESM) by Larson and Csikszentmihalyi (1983). ESM requires participants to answer a short questionnaire, usually focusing on the challenge-skills dimension (Jackson & Eklund, 2002), whenever the participant receives a signal sent randomly (Csikszentmihalyi & Massimini, 1985). Due to the difficulty of ESM implementation in sports, the flow state scale (FSS) was developed (Jackson & Marsh, 1996). The theoretical basis of FSS describes nine original dimensions of flow and consists of 36 items grouped into nine factors, which are measured by a five-point verification scale (Jackson & Marsh, 1996).

Dispositional flow scale (DFS) is a variant of FSS that focuses on the frequency of flow experience, the evaluation of individual differences, and the evaluation of the individual propensity to experience flow

(Jackson et al., 2008; Jackson & Eklund, 2002). Variants of FSS and DFS named FSS-2 and DFS-2 were developed in order to improve the measurement of the nine dimensions of flow through conceptual psychometric enhancements and more suitable factorial scores. All scales are based on five-point agreement scales to questions such as "I did things spontaneously and automatically without having to think" or "The way time passed seemed to be different from normal" (Heyne et al., 2011, p. 477).

The flow short scale (FKS) was created with the argument that 10 items would be sufficient to measure flow in any activity, and that the addition of three items could provide a complementary measurement of the perception about task importance (Engeser & Rheinberg, 2008).

Flow has been measured with scales applied during interviews or by ESM. In the case of extending individual flow to collective flow, individual scores have been summed up to build a collective total score (e.g., Bakker et al., 2011). In its turn, shared flow has been measured by the nine original flow dimensions adapted to collective perceptions, as in rewordings like "We were totally focused (...)" (Zumeta et al., 2016) or "When the group is working, we forget everything else around us" (Salanova et al., 2014), which refers to the original Concentration dimension of flow.

However, people do not always associate their individual interests to group interests, and vice versa (Ryu & Parsons, 2012), what suggests a specific approach to flow research in collaborative contexts, considering alternative means of research and removing explicit mentions to the subject, or conducting inductive-based studies in order to offer comparison elements (emerging dimensions) vis-à-vis original dimensions (Swann *et al*., 2012).

Method and Materials

Our study deployed the following methods: repertory grid and laddering (Jankowicz. 2004), focus groups (López & Pascual, 2008), content analysis (Bardin, 1977), scale development and validation (Costa, 2011; Churchill, 1979; Rossiter, 2002), survey, and multivariate statistics. The study also demanded the use of the following materials: repertory grid sheets and cards for triads sorting (Jankowicz, 2004), question list for guiding the focus group sessions, audio recording equipment, electronic form, statistical software, and interview sorting.

The development and validation of the scale for shared flow measurement in IT teams followed the first four steps of Churchill's (1979) model, namely: construct domain specification, sample generation items, data collection (through survey), and initial purification items and reliability analysis. While this model is primarily focused on statistical indicators, we further included conceptual considerations of qualitative nature, following Rossiter (2002) and Costa (2011), so that decisions about adding, removing, developing and assigning items to dimensions occurred as a result of the researchers' interpretation and, when appropriate, the contribution of experts who were asked to contribute.

Construct Domain Specification (Step 1)

Shared flow could be measured by attributes described by professionals as they have a collective self-perception under cognitive, behavioral and affective-motivational shared states (Pineau et al., 2014; Salanova et al., 2014; Swan et al., 2012). It is expected that a set of such attributes emerges at the peak of collective task.

Given our inductive-based approach, our construct domain involves – not exhaustively – facial expressions, postures, and emotions (Salanova et al., 2014), mutual expectations (Salanova et al., 2014), collaboration (Sawyer, 2003), social integration (Zumeta et al., 2016), and so forth.

Sample of Items Generation (Step 2)

The sample of items was generated through in-depth interviews with IT teams and professionals working in software development. Two techniques were employed in the interviews: focus groups with teams, and repertory grids (plus laddering) with managers. Focus group enabled the evocation of observable measurement items within the team context, through interview situations where mutual influences provided the emergence of collective aspects of teamwork, what would be otherwise hard to retrieve through individual interviews. Repertory grid and laddering enabled the evocation of observable measurement items that lie in the mental models about performance of experienced team project managers (from five to 35 years of experience).

The IT professionals and teams invited to participate in the interviews achieved good levels of performance in software development projects. Also, all individuals manifested traits that are considered positive – such as motivation, self-management, and what we use to call "vibration", that is, the surrounding atmosphere of teams in shared flow. These were our criteria for sample selection.

The invited professionals and teams were identified through our network of personal and professional relationships, according to a successive indication process (snowball). Through this process, we identified universities, business incubators, people, and companies located in Brazil, USA, Portugal, UK, Ireland, and Switzerland. The number of focus groups and repertory grids in this research was not set *a priori*, so that we tried to reach out all teams and professionals that were available.

From July to December 2014, the first author performed 14 interview sessions, six of them consisting of individual repertory grids, and eight consisting of focus groups. A total of 37 individuals participated in the interviews, 31 men and six women. Each interview lasted on average one hour and seven minutes, and transcripts had on average 8.3 pages and 5,862 words. .

Content analysis was applied for the objective and systematic analysis of conversations (Bardin, 1977), since laddering was adopted for in-depth discussion of each construct during interviews. In fact, the elicited constructs were the starting point for further deepening on construct meanings.

The recording units consisted of the topic included in the sentences transcribed from the audio record of each interview (either individual repertory grid or focus group). The derived text of the audio transcript was divided into sentences (speech unit that is meaningful for the researcher). This process produced a data table (TSen) that is the basis for subsequent analysis. Every TSen sentence (3,359 in total) was assigned a unique sequential identifier (ID). Each TSen sentence was also classified according to its nature. For instance, if the sentence referred to a construct or concept, it was classified as a "4" nature; if the sentence referred to a repetition of speech, it was classified as a "6" nature; and so forth. The classification of TSen sentences according to their nature is represented in another table (TNat).

Each sentence coded TNat 4, 8b or 9b (codes of relevance for this study) was analyzed vis-à-vis the constructs previously identified in the literature. To do that, both sentences TSen and constructs previously identified in the literature were normalized into keywords. From each of the 702 remaining sentences we developed a set of keywords arbitrated from the repertoire of terms acquired during the literature review and the interviews. This same procedure was applied to the constructs identified in the literature, so that two sets of standardized keywords were available for comparison.

The two sets of keywords were entered into a relational database (Oracle® Express Edition). Structured query language (SQL) algorithms were developed to identify similarities, differences, and emergences. The algorithms have been tested and adjusted before the application to the data. The comparison strategy allowed the re-examination of the literature (including existing dimensions of flow) vis-à-vis new research data. So, that which seemed to be emergent dimensions effectively were not found in our literature review.

One may question whether the resulting dimensions and items obtained from the professionals and IT teams are the effective manifestation of flow in teams, or just the perception about what happens in the surroundings of teams in flow. In other words, gestures, actions corresponding to mutual expectations, intense communication and interaction, among other factors, would be an indication that the team is in a given level of flow, or a proxy of flow in teams. For this reason, we called the resulting instrument "Vibration Measurement Scale for IT Teams" (Vibe-IT).

Items were phrased as close as possible to what is observed in the practice of software development teams, while measurement items by others (e.g., Salanova et al., 2014; Zumeta et al., 2016) are phrased according to the nine originals dimensions of flow and items. For this reason, we intentionally chose in favor of colloquialism, especially in regard to vibration, treated in the instrument as "cool vibe" in statements like "The team is in a cool vibe when we realize that..." Such an insight was based on the conversation experience and the repertoire of expressions that the first author developed during the interviews, and also on the transcription of the speeches to text format and the analysis of sentences.

“Step 2” was completed after experts in scale development and IT specialists manifested their impressions about the instrument. In particular, rounds of validation were done within our professional networks and with the help of our research team. The main adjustments recommended by the experts concerned the reallocation of items among dimensions, and the rephrasing of sentences – 19 items were rephrased, two items were eliminated, and no item was added. After content and face validation, the Vibe-IT scale consisted of 45 items, which were made available in online form for electronic data collection. We adopted a 10-point verification scale (agreement scale), where “1” means “strongly disagree” and “10” means “strongly agree”.

Data Collection (Step 3)

Data collection was done through an online survey instrument (questionnaire) to be filled by IT professionals working in software development teams. The choice for an individual level of analysis considered that, although the analysis is targeted at the team level, perceptions are still individual. The proposal to refer the respondent (through priming) to a social psychological state aims to raise his/her perception of what is collective, even if it manifests individually. In a future approach, we intend to develop scale scores at team level, or a “model composition” (Klein et al., 2001).

Complementary tests about the quality of the scale were done by master’s and doctoral students. A list of companies and professionals to be invited to answer was then proposed. Invitations to participate were sent through electronic mail, and the message was as personalized as possible to the prospective respondent. We tried to make reference to a particular attribute of the company or the professional that we contacted (a specific project, a specific person, a situation that we experienced together, and so on), so as to increase the personal bonds between the researchers and the intended respondents.

Data collection was concluded in June 2015, with 162 answers. The final sample consisted of 160 valid responses (98.8%), of which 130 (81.3%) came from men, and 30 (18.8%) from women; 154 (96.3%) respondents worked in Brazil, and six (3.8%) worked in other countries (USA, UK, Ireland, Portugal, and Switzerland); 86 (53.8%) respondents worked for private companies, 64 (40.0%) worked for the public sector, and 10 (6.3%) did not inform the company they worked for. The respondents’ average age was 31.7 years (SD = 7.9), with 9.3 years (SD = 7.4) on average of experience with software development. The average size of teams was 9.1 people (SD = 7.5), with a minimum of two and a maximum of 40.

Purification of Items and Reliability Assessment (Step 4)

The procedures for item purification and scale reliability analysis were done by the first author, with the support of statistical techniques such as Pearson correlation, exploratory factor analysis (EFA) and Cronbach's alpha. For the Vibe-IT scale, we found average values ranging between 5.04 and 8.71, and standard deviation ranging from 1.5 to 2.9. Considering that there were no low values for standard deviation (less than 1, which indicates good variance), the whole set of items was considered eligible for correlation analysis.

The first exploratory factor analysis (EFA) was held without determining *a priori* the number of factors and with all the original 45 items. Principal components analysis was applied for the extraction, along with Varimax orthogonal rotation. After two iterations, results suggested nine factors with 43 variables distributed as shown in Table 1. Reliability assessment indicated acceptable alpha values. There was a considerable imbalance in the factorial distribution of items.

Factor	Variables	Reliability
1	V06, V08, V10, V12, V13, V14, V19, V20, V21, V22, V27, V30, V31, V33, V34, V35, V36, V37, V39, V44, V45	$\alpha = 0.953$
2	V24, V25, V26, V41	$\alpha = 0.820$
3	V09, V11, V15, V29, V40	$\alpha = 0.848$
4	V01, V02, V03	$\alpha = 0.833$
5	V04, V05, V23	$\alpha = 0.694$
6	V16, V42	$\alpha = 0.534$
7	V17, V38, V43	$\alpha = 0.611$

Factor	Variables	Reliability
8	V07	
9	V18	

Table 1. Factors and reliability after first EFA on Vibe-IT Scale

The second EFA was also performed without determining the number of factors *a priori*, but considering items in each dimension only (not all scale items simultaneously). After 36 iterations, we concluded that IT team vibration should be measured in six dimensions, with 34 variables distributed as shown in Table 2 and Table 3. Reliability assessment indicated alphas with acceptable values for joint variation of the variables in each dimension, what suggests convergent validity. The two indicators of convergent validity (alphas) described in Table 2 for items 4, 5 and 6 contain the alpha values before and after moving items among factors.

Factor	Variables	Reliability
1	V01, V02, V03, V06	α = 0.787
2	V08, V09, V10, V11, V12, V13	α = 0.862
3	V15, V16, V19, V21, V22	α = 0.818
4	V24, V25, V26 (+V36, +V37)	α = 0.770; 0.835
5	V27, V28, V29, V30, V31 (+V44, +V45)	α = 0.740; 0.833
6	V33 (+V34, +V35, +V38, +V39, +V40, +V41)	α = 0.822; 0.843
7	Moved to factor 6 with V34 and V35	α = 0.822
8	Moved to factor 4 with V36 and V37	α = 0.835
9	Moved to factor 6 with V37 and V38	α = 0.822
10	Moved to factor 6 with V40 and V41	α = 0.843
11	Removed	α = 0.362
12	Moved to factor 5 with V44 and V45	α = 0.833

Table 2. Vibe-IT factors and reliability after second EFA

Some comments on Tables 2 and 3 seem necessary, particularly about the integration of dimensions and the redistribution of items in dimensions. EFA suggests that after the fourth dimension (originally defined as "pressure need") two factors emerged, being V23 with high factor score (0.893) isolated from V24, V25 and V26 (scores 0.806, 0.862 and 0.777, respectively). V23 ("Pressure's up – we're at the time of a product version delivery, for example") refers to a kind of pressure that affects the team from the outside, while the other items suggest internal pressure to the team ("Everyone is capable of self-motivation, even when there is no leader pressure", "There is mutual charging between team members" and "Everyone charges him/herself for results"). Thus, although initially relevant, statistical indicators suggest a new conceptual interpretation of item V23, giving antecedent nature to the phenomenon. Hence the decision for its removal, not only from the dimension, but the scale.

Dimensions 6 (great involvement), 7 (belief in the project and the team) and 9 (mutual support) were merged by conceptual affinity, giving rise to a single dimension formed by five items, with one item coming from dimension 6, two items coming from dimension 7, and two items coming from dimension 9. The resulting dimension was called "COllaboration", spelled this way just to emphasize the etymological aspect of the word, derived from the Latin word "collaborate" which comes from "laborare" (work, tiring) and "with" (together). That is, COllaboration emphasizes work as an activity necessarily collective, carried out together, occasionally discriminating with "collaboration", which can be an aid, help, or when used in expressions such as "collaborate with the campaign ..."

Dimensions 4 (pressure need) and 8 (achievements celebration) were also merged, giving rise to a single dimension formed by five items, with three items coming from dimension 4, and two items coming from dimension 8. The resulting dimension was called "pressure and celebration". For data triangulation purposes, the same dimension 8 (achievements celebration) had its two original items handled together with dimension 1 (expressions) and, in this case, V36 and V37 formed a single factor with discriminant quality in relation to dimension 1, as opposed to convergence with dimension 4.

Dimension 10 (critical peer review) could be merged based on subjective proximity both to dimension 5 (intense communication) and dimension 6 (COllaboration). In the first case, integration would take place due to the communications aspect of peer assessments, while in the second case integration would take place due to the collaborative aspect of the assessments. Dimension 5 focuses on terms such as "interaction", "information exchange", "conversation" and "communication", while dimension 6 focuses on terms such as "joint development of the idea", "cooperation", "effort", "competition". Analyzing the items of dimension 10 in light of these terms (see Table 3), one would conclude that terms such as "guidance" and "critical comments" have more to do with the joint development of ideas (collaborative) than the sharing of information (integrative). Thus, we decided to merge dimensions 10 and 6, resulting in a seven-item dimension. The dimension's name remained "COllaboration", while dimension 5 was renamed "integration".

Items of dimension 11 (balance between privacy and interaction) were iteratively analyzed in each of the dimensions 1, 2, 3, 5 and 6 (4 and 12 do not have conceptual affinity). None of the attempts to merge items of dimension 11 had a positive contribution to factor explanation (variance between 46.8% and 54.0%) and only marginally contributed to factor 5's improvement in reliability (alpha from 0.74 to 0.758). As an autonomous dimension consisting of only two items, the balance between interaction and privacy also failed in convergent validity (α = 0.362). This dimension was eliminated.

Dimension 12 (tune) was observed in composition with each of the other six dimensions. The attempt to integrate it with dimension 1 (expressions) gave rise to two factors, both with high scores and commonalities (0.654 and 0.771), what discouraged the continuation of this alternative. When analyzed together with the other five dimensions (2 to 6), one factor was observed in all situations. There was no indication for the removal of items (adequate scores and commonalities) and alpha ranged between 0.833 and 0.882. While as a single dimension formed by just two items, the "tune" dimension proved to be convergent (α = 690). Having no restriction or distinction with statistical support, we decided according to its conceptual definition. The "tune" dimension evokes intimacy among team members. Intimacy refers to consequences of living time and shared life experiences (work and, often, leisure). Being tuned at this level has to do with team integration. We decided, therefore, to integrate dimension 12 to dimension 5, keeping the "integration" designation for the last one. Table 3 shows the final Vibe-IT scale.

Dimension/ Factor	Items The team is in a cool vibe when we realize that...
Expressions	(V01) ... there are specific gestures (for example, my friend does a drum solo in the air or slides the chair back when s/he completes a difficult activity). (V03) ... there are specific sounds (for example, my friend makes a different noise with her/his mouth when s/he completes a difficult activity). (V04) ... everyone is walking in a very different way (for example, in a hurry). (V06) ... everyone is excited, wanting to show others what s/he did.
Mutual expectations	(V08) ... everyone is engaged (my friends know what to do and have initiative, nobody is seen as "bum" or "vagabond"). (V09) ... everyone knows the importance of completing the task (my friends know the deadlines and share the risk of success/failure). (V10) ... there is abetment/complicity for troubleshooting (my friends and I work together to solve problems). (V11) ... past mistakes don't occur anymore (my friends avoid error recurrence). (V12) ... everyone is willing to share knowledge (with my friends, we don't have this thing, only that guy knows this, so-and-so knows that). (V13) ... even with jokes and relaxation, we focus on productivity (my friends know when kidding or working, even when we are having fun).
Authentic participation	(V15) ... everybody discusses ideas with maturity. (V16) ... there is enough maturity to understand when aid denial is ill or when one is unavailable just for being busy.

Dimension/ Factor	Items The team is in a cool vibe when we realize that...
	(V19) ... there is room for initiative (we can propose changes to the project). (V21) ... colleagues (including the team leader) accept being openly criticized . (V22) ... we have agility to discuss a solution (for example, with my friends we talk straight, decide at time).
Pressure and celebration	(V24) ... everyone is able to self motivate, even when there is no leader pressure. (V25) ... there is mutual charging among members in order to reach the goal. (V26) ... everyone charges him/herself for results. (V36) ... throw a party for celebrating joint work results. (V37) ... when the team overcomes the "hard time" after some peak of engagement, everyone laughs (there is joint relaxation, which is even cooler because everything worked out).
Integration	(V27) ... there is intense communication in the team. (V28) ... everyone talks to each other in person, by chat, WhatsApp etc. (V29) ... there is intense exchange of information, specifications, details etc. (V30) ... one wants to show to the other his/her solution for a problem, the task done (my friend calls the others and says "look how beautiful is the thing I did"). (V31) ... intense interaction is going on even with people more retracted or considered inaccessible. (V44) ... we know each other well so far as to predict what the other will do. (V45) ... we are tuned (for example, sometimes a friend is thinking one thing and others already know what they have to do).
COllaboratio n	(V33) ... the idea is being jointly developed (for example, my friend speaks, the other complements, one says something else, and we develop the idea together). (V34) ... everyone believes in the project (a friend cares if the presentation of the final version will be ok, and the other is running tests all the time). (V35) ... everyone does his/her best to make the project work out. (V38) ... there is healthy competition. (V39) ... each member, even trying to do his/her best, is still able to cooperate. (V40) ... there is guidance between team members (one always tells the other if s/he is heading to the right direction). (V41) ... there are critical and constructive comments (for example, my friend always double checks with whom is on his/her side, "So, what do you think?").

Table 3. Vibe-IT Scale

Conclusions

This study achieves its purpose by proposing a specific instrument for shared flow measurement in work teams, specifically in IT teams, through a proxy for flow (vibration). We achieved this through the convergence of three main sources of information: (a) IT professionals (37 software developers interviewed individually or in their teams), (b) experts on IT and scale development (five experts), and (c) IT professionals (160 software developers that participated in our survey); and with the help of flow theory (Csikszentmihalyi, 1990) and a set of methods and techniques (repertory grid, laddering, focus groups, content analysis, online survey, and multivariate statistics).

Our Vibe-IT scale has 34 items that are grouped into six dimensions (expression, mutual expectations, authentic participation, pressure and celebration, integration, and COllaboration) that consider collective perceptions of what goes on in the surroundings of a team in shared flow.

Theoretical Implications

Taking into account that flow research has generally employed individually targeted instruments, focused on individual perceptions (e.g., "I feel (...)") and employed generic instruments (ESM, FSS, FSS-2, etc.) combined with various scales to meet particularities, the availability of an instrument focused on the collective perceptions and developed specifically to measure these perceptions in IT work teams contributes immediately to the understanding of how teams (consciously or not, reflexively or not) perceive themselves and their surroundings. Such a specific instrument also contributes to the acquisition of new knowledge about team dynamics. This theoretical contribution meets a demand by Engeser and Schiepe-Tiska (2012) and Nakamura and Csikszentmihalyi (2005), and it adds to a body of knowledge (e.g., Aubé et al., 2014; Heyne et al., 2011; Pineau et al., 2014; Salanova et al., 2014; Zumeta et al., 2016).

Taking also into account other studies in the same avenue, our approach differs, for instance, from those of Salanova et al. (2014) and Zumeta et al. (2016) mainly in hypothesizing on the emerging attributes of team members during their simultaneous and collective states of flow, and assuming that shared flow is adequately measured under the Gestalt's super-summative concept. So, it seems reasonable the occurrence of emerging attributes which are not measured by the original dimensions of individual flow, as supposed by Swann et al. (2012). In fact, the inductive-based approach adopted in our study explains the reasons for identifying attributes that emerge in the relationship among members of a team during their actions and that are not usually adopted when measuring shared flow.

Finally, the existence of a flow measurement instrument may support the measurement of flow influence on IT team performance, which, in turn, seeks to fill the gap about professional effectiveness (a measure of performance) at the team level, and the relation of this effectiveness with flow.

Managerial Implications

As some of our interviewed professionals said, team "grip" is contagious, especially for those who entered as a "rookie". If the team is vibrant and seeks professional effectiveness, it "infects" novices with that vibration – but likewise, apathy, boredom and dispersion do. Therefore, recognizing and valuing vibrant professionals in light of the concepts here discussed may be a good managerial practice.

A preference for hiring people able to adapt and learn quickly – rather than competent people who have already mastered – seems to pose difficulties to the occurrence of flow in teams, especially as the assumptions of validity of flow dimensions balance between challenge and skills, and action-awareness (since they assume "knowledge at the fingertips"). In this case, when discussing flow at work, a significant part of this effort consists in getting to learn how to do at the time doing is being done. It would be up to the IT professionals to recognize themselves as learners (this would be their main skill), and learning would be their main task (that would be *the* challenge). This observation has implications also on maintaining a balance between challenge and skills, what we call the "spiral" of challenge-skills. Part of the spiral consists, therefore, in the continuous promotion of balance between challenge and skills.

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