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# FLOW EXPERIENCE AMONG INFORMATION AND COMMUNICATION TECHNOLOGY USERS[1,2]

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*Summary.*—The use of technologies is more common in daily life; working with technologies might be associated with positive experiences such as flow. However, there is little empirical research on flow experiences in technology settings. The main aim of this study was to confirm the three-dimensional construct of flow, i.e., absorption, enjoyment, and intrinsic interest, among 517 Information and Communication Technology users [234 students whose mean age was 23 yr. ($SD=3.8$)] from different areas of study, mainly Law, Public Administration, Chemistry, and Psychology, and 283 employees [whose mean age was 33 yr. ($SD=7.8$)] of 21 different companies from various sectors of production, namely, public administration, industrial production, and services. Analysis showed, as expected, flow is a three-dimensional psychological construct and invariant among samples of technology users. Practical and theoretical implications as well as further research are discussed.

The concept of 'flow' has been of interest to researchers since it was introduced by Csikszentmihalyi (1975, 1990; Csikszentmihalyi & Csikszentmihalyi, 1988). He interviewed professionals such as artists, athletes . . . and scientists, and asked them to describe "optimal experiences" that made them feel good and motivated them because they were doing something that was worth doing for its own sake. He coined this experience 'flow' because many interviewees used this term spontaneously to explain what their optimal experience felt like (Csikszentmihalyi & Csikszentmihalyi, 1988). Thus, flow is defined as an optimal and extremely enjoyable experience. It is characterized by total concentration and joy and high interest in the activity (Moneta & Csikszentmihalyi, 1996).

Flow is a complex concept difficult to operationalize particularly because in the original description of Csikszentmihalyi (1975, 1990, 1997; Csikszentmihalyi & Csikszentmihalyi, 1988) the flow experience itself is confounded with its antecedents and consequences. For instance, Csikszentmi-

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halyi (1990, 1997) describes flow in terms of nine dimensions: clear goals, immediate feedback, personal skills well suited to given challenges, merger of action and awareness, concentration on the task, sense of control, loss of self-consciousness, altered sense of time, and the experience becoming "autotelic," i.e., for its own sake or intrinsically rewarding. However, a closer look shows clear goals, immediate feedback, and personal skills well suited to given challenges can be considered as antecedents or necessary conditions for flow, whereas the experience becoming "autotelic" might be considered a consequence.

To date, over three decades after the concept of flow was introduced, there is still no agreement about its operationalization. For instance, it has been maintained that flow is characterized by the perception of a balance between high environmental challenges and adequate personal skills, deep concentration, involvement, enjoyment, control of the situation, clear-cut feedback on the course of the activity, and intrinsic motivation (Deci & Ryan, 1985). Chen (2006) defined flow as a state that is "characterized by enjoyable feelings, concentration, immersion, and intensive involvement" (p. 222). In a similar vein, Ghani and Deshpande (1994, p. 383) described flow in the context of human-computer interaction, as "(a) total concentration in an activity and (b) the enjoyment which one derives from an activity."

A critical examination of the literature suggests that most definitions of flow seem to have three elements in common. The first refers to a sense of involvement, total concentration, focused attention or loss of self-consciousness, in other words, being entirely engrossed in the activity at hand (Trevino & Webster, 1992; Ghani & Deshpande, 1994; Lutz & Guiry, 1994; Moneta & Csikszentmihalyi, 1996; Csikszentmihalyi, 1997; Novak & Hoffman, 1997[3]). Here, this deep involvement is labelled Absorption. A second common element involves positive feelings of enjoyment that are associated with the activity (Privette & Bundrick, 1987; Ghani & Deshpande, 1994; Moneta & Csikszentmihalyi, 1996; Novak & Hoffman, 1997[3]). That is, the activity is perceived as intrinsically enjoyable, so the second characteristic is labelled Enjoyment. The last element refers to the interest in performing the activity for its own sake rather than for an extrinsic reason (Trevino & Webster, 1992; Moneta & Csikszentmihalyi, 1996; Novak & Hoffman, 1997[3]). This is labelled Intrinsic Interest. One must note that, according to the meaning of flow, items refer to flow like an optimal experience related with a specific activity rather than a general behaviour during the work. In such a way, it makes more sense to measure Intrinsic Interest than Intrinsic Motivation.

[3]Novak, T. P., & Hoffman, D. L. (1997) Measuring the flow experience among web users. Paper presented at Interval Research Corp. Retrieved from http://www2000.ogsm.vanderbilt.edu/research_papers.htm.

Also according to the flow definition provided by Moneta and Csikszentmihalyi (1996), they used the term 'high interest' and not motivation related with a specific activity. Here 'interest' is used instead of 'motivation' to be closer to this original definition of flow.

In sum, based on the common elements in various descriptions of flow, three elements are proposed as main components of the flow experience: Absorption, Enjoyment, and Intrinsic Interest. At least three previous studies have used this operationalization of flow and found that the intercorrelations between these three flow components were relatively high in samples of music teachers and students (Bakker, 2005), secondary school teachers (Salanova, Bakker, & Llorens, 2006), and also in workers from small and medium sized companies (Demerouti, 2006). In these three studies, correlations between Absorption, Enjoyment, and Intrinsic Interest scales range from .40 to .83 (mean correlation, .60). However, few of these studies examined the factorial validity of the three-dimensional measure of flow.

In addition, all three studies used the same measure of flow, which was rather general. However, according to the original meaning of flow as a short-term optimal experience that is inherent to a specific activity, it seems more appropriate to operationalize it in terms of a specific work activity, for instance, while using Information and Communication Technologies (ICT). This specific group was selected because flow is quite prevalent among those who use ICT, presumably because of the intrinsically motivating nature of these technologies (Chen, Wigand, & Nilan, 2000). Specific items that refer to the use of ICT were used. So instead of including general flow items such as "I do my work with a lot of enjoyment" and "When I am working, I forget everything else around me" as was done in the three studies of flow mentioned above, more specific items were included, such as "I enjoy the work I do using these technologies" and "When I'm working with these technologies, I forget everything else around me."

Hence, according to the meaning of flow experience and the need to use specific measures to assess this optimal experience, the present study had two hypotheses. First, it was expected that a three-factorial model including Absorption, Enjoyment, and Intrinsic Interest would fit the data better than a one-dimensional model in which all items were assumed to be loaded on one underlying undifferentiated flow dimension (Hypothesis 1). Second, it was expected that the three-factor model would be invariant across both workers and students who use ICT (Hypothesis 2).

## Method

### *Participants*

Sample 1 consisted of 234 university students (66% women) enrolled in various graduate and undergraduate programs. Ages ranged from 17 to 43 years ($M=23$, $SD=3.8$). Only those students who used ICT daily were included, for instance, by browsing through the internet, word processing, or using spreadsheets or statistical software packages.

Sample 2 was made up of 283 employees (61% women). Ages ranged from 18 to 60 years ($M=33$, $SD=7.8$). They worked in 21 different companies and in various occupational sectors, ranging from agriculture to public administration. Like the students, the employees were included based on their daily use of ICT.

*Measure*

The questionnaire included a wide range of variables, among others, both students and employees were asked to specify the type of software they used and to describe their daily work activities.

Flow was measured using three subscales (see Appendix 1, p. 39). Absorption was assessed using a slightly adapted version of the Absorption scale of the Utrecht Work Engagement Scale (Schaufeli, Salanova, González-Romá, & Bakker, 2002). All five items were reworded to refer specifically to ICT work; for instance, the item 'Time flies when I'm working' was rephrased as 'Time flies when I'm working with technologies'.

Intrinsic Interest and Enjoyment were each assessed using a self-constructed 3-item scale based on previous research (Rodríguez, Cifre, & Salanova, 2004; Rodríguez, Salanova, & Cifre, 2004). In the introduction, two examples were given of reformulated items.

The participants were asked to indicate how often they had flow experiences during the preceding week. All flow items were scored on a 6-point frequency scale, the scale of answers was 0 = Not at all/never; 1 = Hardly at all/a couple of times a year; 2 = Rarely/once a month; 3 = Sometimes/a couple of times a month; 4 = Fairly often/once a week; 5 = Frequently/a couple of times a week; and 6 = Always/every day.

*Procedure*

Students (Sample 1) and employees (Sample 2) were asked to participate in the study by Ph.D. Students who approached various universities and companies. Sample 1 was chosen for two reasons: first, because students use ICT in their daily work as students and, second, it was a convenient sample easy to approach. Similarly, Sample 2 was chosen because the companies were familiar to Ph.D. students who conducted the research. Only respondents from ICT jobs were sampled. All respondents, who voluntarily participated in the study, filled in the paper-and-pencil version of the Resources, Emotions, and Demands.Information and Communication Technologies (RED.TIC) questionnaire. This questionnaire starts with a section dealing with general information (i.e., age, education, kind of job, and working hours) that asks about the kind of technology the person uses, experience with ICT, etc. In the present study, this section was used to uncover whether both samples studied and worked using ICT and in which kind of ICT activities they were involved.

## Results

### *Descriptive Statistics*

Students used word processors (99%), internet (86%), spreadsheet (80%), database (60%), PowerPoint (62%), and statistics packages (38%). Employees used word processors (94%), electronic mail (91%), spreadsheet (86%), internet (80%), and intranet (70%). Both samples were asked to fill out the flow items imagining ICT activities they mentioned previously.

Table 1 shows the means, standard deviations, internal consistencies (Cronbach α), and intercorrelations of the three flow scales in both samples.

TABLE 1

Means and Standard Deviations For Three Factors of Flow, Cronbach Alphas (Students/Employees) on the Diagonal, and Pearson Correlations Among Study Variables

| Dimensions of Flow | Students | | Employees | | *r* | | |
|---|---|---|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* | 1 | 2 | 3 |
| 1. Absorption | 2.84 | 1.19 | 2.92 | 1.21 | .84/.86 | .42† | .37† |
| 2. Intrinsic interest | 2.79 | 1.39 | 2.89 | 1.44 | .48† | .85/.80 | .58† |
| 3. Enjoyment | 3.25 | 1.34 | 3.86 | 1.29 | .49† | .62† | .88/.85 |

*Note.*—Employees below the diagonal. †$p < .01$.

As can be seen from Table 1, all variables demonstrated good internal consistencies by not only satisfying the usual criterion of α greater than .70 (Nunnally & Bernstein, 1994), but even the more stringent criterion of α greater than .80 (Henson, 2001). In addition, Table 1 shows that Absorption, Intrinsic Interest, and Enjoyment correlate positively and significantly. Mean correlations among students and employees were .46 and .53, respectively.

### *Factorial Structure of Flow*

To test Hypothesis 1, two alternative models were fitted to the data separately for each sample, using confirmatory factor analyses: a one-factor model ($M_1$) that assumed one latent variable underlying all flow items, and a three-factor model ($M_2$) that assumed that items would load on three correlated scales: Absorption, Intrinsic Interest, and Enjoyment. The AMOS 4.0 software package (Arbuckle & Wothke, 1999) was used to analyze data. Table 2 shows the results for Sample 1 and Sample 2 for the one-factor model ($M_1$), the three-factor model ($M_2$), and the null model ($M_3$, reference model).

$M_1$ did not fit the data well; the nonnormed fit index (NNFI) and the comparative fit index (CFI) fell below the acceptance criterion of .90

TABLE 2
CONFIRMATORY FACTOR ANALYSES OF THREE DIMENSIONS OF FLOW (*ns* = 234 STUDENTS, 283 EMPLOYEES)

| | Students | | | Employees | | |
|---|---|---|---|---|---|---|
| | Model | | | Model | | |
| | $M_1$ 1 Factor | $M_2$ 3 Factors | $M_3$ Null Model | $M_1$ 1 Factor | $M_2$ 3 Factors | $M_3$ Null Model |
| $\chi^2$ | 440.51 | 49.22 | 1209.67 | 523.17 | 137.54 | 1606.69 |
| *df* | 44 | 41 | 55 | 44 | 41 | 55 |
| *p* | .001 | .17 | .001 | .001 | .001 | .001 |
| GFI | .69 | .96 | .39 | .69 | .92 | .34 |
| AGFI | .54 | .94 | .27 | .54 | .87 | .21 |
| RMSEA | .20 | .03 | .30 | .20 | .09 | .31 |
| NNFI | .64 | .96 | | .67 | .91 | |
| CFI | .66 | .99 | | .69 | .94 | |
| IFI | .66 | .99 | | .69 | .94 | |
| $\Delta\chi^2$ | $M_1 - M_2 = 391.29$† | | | $M_1 - M_2 = 385.63$† | | |
| $\Delta df$ | 3 | | | 3 | | |

†$p < .001$.

(Hoyle, 1995) in Sample 1 (NNFI = .64; CFI = .66) as well as in Sample 2 (NNFI = .67; CFI = .69). The value for the root mean square error of approximation (RMSEA) was also higher than the critical value of .08 (Browne & Cudeck, 1993) in Sample 1 (RMSEA = .20) and also in Sample 2 (RMSEA = .20). In contrast, the hypothesized Model $M_2$ fit the data well, with values for both relative fit indexes above .90 in Sample 1 (NNFI = .96; CFI = .99) and in Sample 2 (NNFI = .91; CFI = .94). Also, the value of RMSEA was below .08 in Sample 1 and approached this criterion in Sample 2. The results of the chi-square difference between $M_1$ and $M_2$ showed a superior fit of $M_2$ for both samples (see Table 2). Hence, it was concluded that rather than one undifferentiated dimension, flow includes three correlated dimensions, Absorption, Enjoyment, and Intrinsic Interest, which supported Hypothesis 1.

*Factorial Variance/Invariance Across Samples*

To assess the invariance of the three-factor model of flow, this model was fitted simultaneously to the data of both samples, using multigroup analyses (MGA). As can be seen from Table 3, $M_1$ fits the data well (NNFI, CFI, IFI > .90; RMSEA < .08).

Next, a model ($M_2$) was fitted to the data in which all factor loadings as well as all covariances between the three latent factors were constrained to be equal across both samples. As can be seen from Table 3, compared to the freely estimated model ($M_1$), the fit of this fully constrained model ($M_2$) did not improve. The fact that $M_1$ and $M_2$ fit equally well to the data of both samples suggested that the factor loadings and the covariances between the factors did not differ significantly between samples. In other words, the three-factor model of flow was invariant across students and employees, which supported Hypothesis 2.

TABLE 3
MULTIGROUP CONFIRMATORY FACTOR ANALYSES OF THREE DIMENSIONS OF FLOW (*ns* = 234 STUDENTS, 283 EMPLOYEES)

| | Model | | |
|---|---|---|---|
| | $M_1$ 3 Factors Free | $M_2$ Full Constrained | $M_3$ Null Model |
| $\chi^2$ | 186.73 | 199.26 | 2816.31 |
| *df* | 82 | 93 | 110 |
| *p* | <.01 | <.01 | <.01 |
| GFI | .94 | .93 | .36 |
| AGFI | .90 | .90 | .23 |
| RMSEA | .05 | .04 | .21 |
| NNFI | .95 | .95 | |
| CFI | .96 | .96 | |
| IFI | .96 | .96 | |
| $\Delta\chi^2$ | | $M_2 - M_1 = 12.53$* | |
| $\Delta df$ | | 11 | |

*ns.

Fig. 1 displays the standardized factor-loadings and correlations between factors in both samples. Please note that the differences between the standardized indices are not significant for both samples.

## DISCUSSION

The aim of this study was to investigate the three-dimensional construct of flow, Absorption, Enjoyment, and Intrinsic Interest among 517 Information and Communication Technology (ICT) users and to check its invariance across samples. In this sense, the results supported Hypothesis 1, that assumed that rather than a unitary construct, the flow experience is multidimensional and includes absorption, intrinsic interest, and enjoyment. According to the results, 14% and 50% of the variance between the flow factors was shared, indicating a moderate overlap. In addition, all the three subscales showed a high degree of internal consistency.

Also, Hypothesis 2 was supported since multigroup analyses showed the invariance of the three-factor model of flow across both samples, students and employees. In other words, the three-dimensional flow experience can be generalized across two quite different groups that have in common that they frequently use ICT.

These findings supported the factorial validity of the three-factor model of flow that was used in previous studies (Bakker, 2005; Demerouti, 2006;

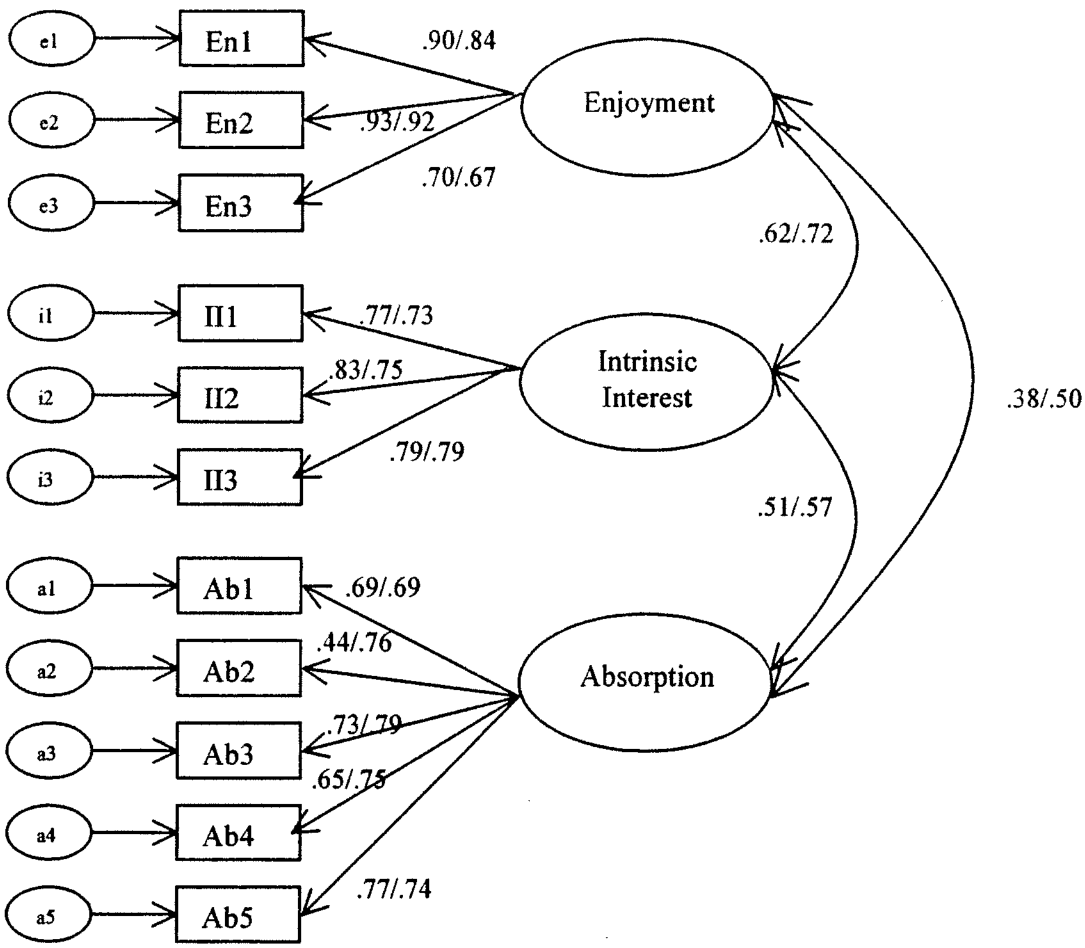


FIG. 1. Three-factor model of flow based on CFA using multigroup analysis for 234 students and 283 employees

Salanova, *et al.*, 2006). In addition, the findings also showed that the flow experience can very well be operationalized using *specific* rather than general items as used in previous research. This is a main contribution of the present study. Accordingly, the present study indicates the need to use items that refer, in this case, to the use of ICT, to assess flow during a specific activity.

As we stated in the introduction, the theoretical framework for the present study was the three-dimensional operationalization of flow used in previous studies (Bakker, 2005; Demerouti, 2006; Salanova, *et al.*, 2006), except that, in the present study, flow was considered to be an optimal experience that is by definition related to specific activities rather than to the job in general. Although the three previously mentioned dimensions of flow have been used by others, the present study makes two main contributions: firstly, testing the factorial validity of this specific operationalization of flow across different samples and, secondly, the use of specific measure of flow (related to work with ICT) rather than a general measure (related to work in general). In other words, the assessment of the flow experience by means of this measure was in the context of technology use. Using a specific measure of flow, for instance in the context of ICT, allows discrimination of flow from a related concept, work engagement. Work engagement is defined as a persistent, pervasive, and positive affective-motivational state of fulfilment in employees that is not focused on any particular object, event, individual or behaviour (Schaufeli, *et al.*, 2002). So the difference between work engagement and flow is that the former is a more general and pervasive state of mind that is related to the job as such, whereas the latter is a specific optimal experience of limited duration and related to a specific activity. It is plausible that engaged employees are more likely to experience short-time, transitory, optimal experiences (flow) during their work, compared to those who are not engaged. Using the present operationalization of flow as an optimal experience that occurs in *specific* work activities, it was possible to test this hypothesis. In the case of the more general operationalization of flow, the concept is almost equivalent with work engagement. Based on the present results, it is proposed that specific flow questionnaires be used in research that are tailored towards specific work activities such as working with pupils (teachers), manufacturing (craftsmen), research (R&D employees), solving logistic puzzles (work planners), and so on.

Based on the above reasoning, future research could explore the relationship between work engagement, as a kind of 'predisposition' for experiencing flow, and the flow experience itself. Also, another relevant issue is to explore the nature of the activities that are highly related to flow, for instance, in this case it would be interesting to study the differences, regarding flow experience, between working with a spreadsheet or working with PowerPoint. This is also related with another avenue for research, that is, to study the antecedents and consequences of flow. Various authors have pointed to the issue that in the original definition of flow, the experience is confounded with causes and consequences (Trevino & Webster, 1992; Ghani & Deshpande, 1994; Chen, *et al.*, 2000; Finneran & Zhang, 2003). Using the present flow measure which assesses the flow experience itself, this challenge can be taken up. Of special interest is to investigate to what extent the three dimensions of flow that were identified are *differently* related to antecedents and consequences. In other words, for research on flow, it would be interesting to know more about which conditions are needed to experience flow (antecedents) and the consequences of its experience.

While it may seem that much has already been achieved, flow researchers still have a long way to go. Since Csikszentmihalyi introduced flow in 1975, many researchers have taken an interest in this intriguing state of optimal experience and studied it in such different fields as sports, games, music, and work, (Nakamura & Csikszentmihalyi, 2002). Based on the present results, a brief, specific self-report questionnaire that consists of three related dimensions, Absorption, Enjoyment, and Intrinsic Interest, could be used for assessing the flow experience.

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## APPENDIX 1

### FLOW ITEMS OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

Enjoyment

1. I like working with ICT.
2. I enjoy the work I do using ICT.
3. I like working with ICT more than other people do.

Absorption

1. When I'm working with ICT, I forget everything else around me.
2. Time flies when I'm working with ICT.
3. I get carried away when I'm working with ICT.
4. I'm engrossed when I work with ICT.
5. When I work with ICT, I don't think about anything else.

Intrinsic Interest

1. I work with ICTs because I like it, not because I have to.
2. I like spending some of my free time using ICT.
3. In itself, ICT is motivating.