

## ***Self-Assessment of Training Impact at Work: Validation of a Measurement Scale***

**Gardênia Abbad<sup>1</sup>**  
**Jairo Eduardo Borges-Andrade**  
**Lúcia Henriques Sallorenzo**  
*Universidade de Brasília, Brasil*

### **Abstract**

This paper describes the development and validation of a measurement scale for *Training Impact at Work*. Impact is defined as the training long-term effect on work performance, motivation and/or attitudes. Two weeks after training, a questionnaire with 12 *impact* evaluation items was applied to participants from 226 courses that had been offered by a Brazilian public organization. The 1.270 valid answers were submitted to factor analyses (PAF, *direct-oblimin*) and to reliability analyses (Cronbach's Alpha). A two sub-scale structure was found ( $\alpha=0.86$ ;  $r=.56$ ) accounting for 60 percent of the *impact* variability. A single factor structure was also found and it is similarly reliable ( $\alpha=.90$ ), accounting for 45 percent of the variability. Both structures are useful, reliable and valid.

*Keywords:* Labour; program evaluation; measurement; test construction.

### **Auto-Avaliação de Impacto do Treinamento no Trabalho: Validação de uma Escala**

### **Resumo**

Este artigo descreve o desenvolvimento e a validação de uma escala de avaliação do Impacto do Treinamento no Trabalho. Impacto é definido como o efeito do treinamento a longo prazo no desempenho, motivação e/ou atitudes. Duas semanas após o treinamento, foi aplicado um questionário com 12 itens de avaliação de impacto, em participantes de 226 cursos oferecidos por uma organização pública brasileira. As 1.270 respostas válidas foram submetidas à análise fatorial (PAF, *direct-oblimin*) e de confiabilidade (Alpha de Cronbach). Dois tipos de estruturas fatoriais foram encontrados: uma com duas escalas ( $\alpha=0,86$ ;  $r=0,56$ ) e outra unifatorial ( $\alpha=0,90$ ) explicando, respectivamente, 60% e 45% da variabilidade de impacto. Ambas as estruturas são úteis, confiáveis e válidas.

*Palavras-chave:* Trabalho, avaliação de programa; medidas; construção do teste.

This paper reports an experience of developing and validating a measurement scale of Training Impact at Work. This research has made possible the creation of a psychometrically valid tool applicable in studies related to the effects of training on individual performance. According to Borges-Andrade and Abbad (1996) and Abbad (1999), this sort of investigation is rare both in national and foreign literature. Few attempts have been made in connection with organizing measurements to determine the level of training effectiveness involving trained individuals. The lack of reliable, valid measurements of learning, reaction (satisfaction with training) and training impact at work may be one of the factors that have been hindering research progress in the training evaluation area.

*Training impact at work* is one of the main criterion variables of training evaluation models and corresponds to the third level of evaluation in more traditional approaches

such as those of Kirkpatrick (1976, 1977) and Hamblin (1978). Job impact is an indirect result of training, and it is defined as the effect of training on the trainees' performance, motivation and/or attitudes.

Kirkpatrick's (1976, 1977) and Hamblin's (1978) approaches suggest that criterion variables such as *reactions, learning, job performance (impact) and results (or organization change and final value)* keep a highly positive relation among them. However, according to Alliger and Janak (1989), specialized literature on training evaluation has shown that those relations are not always significant or not always in the direction foreseen by such approaches. Research results have revealed situations in which a participant - despite showing contentment (a favorable reaction) with training and having obtained good scores in learning evaluations - would not apply his or her newly acquired skills at work. In this case, such a trainee has failed to produce a positive training transfer, not necessarily because of poor memory, poor retention capability, and poor generalization, or due to shortcomings on the training program, but because opportunities to put the things he or she has learned into practice in the work environment have been missing.

<sup>1</sup> Address: SQN 205, Bloco C, Apt. 201 - 70843-030 Brasília, DF, Brasil. Telephones: (55-61) 272-0043 or 307-2625. Ext.: 222. Fax: (55-61) 347-7746. E-mail: gardenia@unb.br, gardenia@brturbo.com

Researchers have given little attention to the evaluation of assumptions related to Kirkpatrick's model (1976, 1977) and have neglected the importance of doing further studies on the interrelation of the criterion variable. Goldstein (1991) has defended the idea that reaction measurements are of little avail as learning predictors and make sense only when related to training needs. Furthermore, according to Goldstein as well as Tannenbaum and Yukl (1992), learning should be considered only as a needed - although not sufficient - condition for transfer or impact at work.

Results of recent research presented by Tannenbaum and Yukl (1992) have not confirmed the significant relation between learning and transfer (impact) measurements as well as between reaction measurements and other criteria (learning, impact, and results). Some results have shown, however, that the reaction level played a moderating role on the motivation/learning relation. In view of this, instructional program efficiency should not be determined by evaluating only one variable level, as it has commonly been done in the area.

Such findings related to the weak relationships between *reaction*, *learning*, and *impact* are not conclusive. Few attempts have been made to identify predicting variables of each of these evaluation levels and to build up reliable measurements of different evaluation levels have been made. In this context, the purpose of this paper is to present a reliable measurement of training impact at work which can make possible a careful and more precise evaluation of relationships among criterion variables of training effectiveness.

### Method

This article describes the development and validation of a *Training Impact at Work Scale*. The tool has been developed in three stages - development, semantic validation, and statistical validation. The *Training Impact at Work Scale* described in this paper is part of the data collecting tools used by Abbad (1999) in a research effort analyzing 226 courses from March 1997 to June 1998 at a training agency in a Brazilian public organization.

#### Developing and Semantically Validating the Scale

*Training Impact at Work* is an indirect result of training and it is defined as the effect of training on trainees' performance, motivation and/or attitudes. The definition of *impact* adopted in this paper, as well as the working up of the measurement tool in this construct, has been highly influenced by the methodological and theoretical features of the works of Basarab and Root (1992), Leitão (1996), Lima, Borges-Andrade, and Vieira (1989), Noe (1986), Noe and Schmitt (1986) and Paula (1992), from whom the questions have been taken.

*Training Impact at Work* has been measured by means of self-assessment at two different moments - two weeks and two months after training. On both occasions, the questionnaires had the same dimensions, items, and scales, and their differences were in connection only with the orientations and time of application. A Green Format questionnaire was sent to participants two weeks after the end of the course, while a Blue Format was sent three months after the end of the course.

The aforementioned questionnaires contained - in their first part - items related to *Training Impact at Work*, and also items about Situational Supporting Factors, Material Support to Transfer of Training, and Consequences Associated to the Use of Newly Acquired Skills at Work. The last three parts, belonging to the category called *Supporting Transfer*, are not the focus of this paper. Furthermore, the questionnaires included also instructions for filling in, deadline, and guidelines on how they should be returned to the training agency. Impact evaluation items were associated to a 5-point Likert scale where 1 corresponded to *I totally disagree with this statement* and 5 to *I totally agree with this statement*. The questionnaires were submitted to semantic validation in a sample of 14 individuals that was similar to the one of training participants.

#### Statistical Validation Procedures

The 12-item questionnaire on *Training Impact at Work* (IMTT) was applied on two different occasions to a sample of workers from the organization that has served as a training agency headquarters - two weeks and three months after training. Before completing the Green Format and the Blue Format questionnaires, sample participants had already completed two other questionnaires. The only differences between the Green and the Blue formats were related to guidelines, color and time of application. The 12 impact items, however, were the same.

Two thousand nine hundred and nine Green Format IMTT questionnaires - and the same number of Blue Format questionnaires - were sent via internal mail to all workers who had participated in training activities. Directions required participants to return their fully completed questionnaires to the training agency within no later than 15 working days.

The validation sample for the *Training Impact at Work* scale included workers who attended 171 courses during 1997 as well as 57 courses during 1998. Those courses were divided in specific areas as follow: Auditing - 25, Law Studies - 20, Public Administration - 10, Entrepreneurial Administration - 2, Organizational Management - 65, Expression and Communication - 7, Computer Technology - 80, International Studies - 3, Administrative Activities - 6, Supervising - 1, and Grammar and Writing - 8. The average number of participants was 18.4 ( $SD=5.77$ ). Small classes consisted of 6 workers; large ones consisted of 32. The total average of class hours was 18.03 ( $SD=0.36$ ), and the daily amount was 3.04 hours ( $SD=0.19$ ).

More than half of the sample (55.7%) were males, 74.5% of them were middle-aged (30 to 50 years of age) and most of them (74.1%) had an university degree. Regarding functional characteristics, the sample had a balanced structure as to job position (55.9% had a job position due to an university degree; the remaining ones were high school graduates). For most of the sample (65.5%), seniority ranged from one to ten years.

Firstly, as Tabachnick and Fidell (1996) recommend, data obtained through questionnaires were submitted to descriptive and exploratory statistical analyses. Secondly, they were submitted to an analysis of the principal components, a factor analysis (PAF, oblique rotation - *direct oblimin*), as well as an analysis of their internal consistency (Cronbach's Alpha). Such analyses have allowed examining the data empirical structure, validating the questionnaires' content and evaluating their reliability.

**Results**

This section presents the results gathered from the statistical validation process of the *Training Impact at Work* questionnaires, for both formats.

**Training Impact at Work Scale Validation - Green Format**

The return rate of the *Training Impact at Work - Green Format* questionnaire was approximately of 43.66%. This corresponds to a final sample of approximately 1,270 valid answers per item. Answers were submitted to an analysis of their principal components in line with Kaiser's method - *eigenvalue* > 1. As verified by KMO (.93), the data matrix could be factorized. Figure 1 shows the *scree plot* containing the scale principal components.

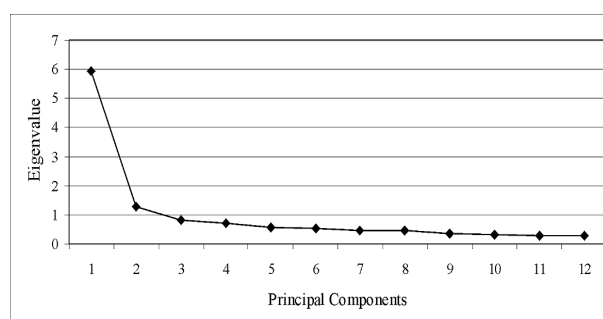


Figure 1. Principal components of the training impact at work - Green Format Scale

Results issued after analyzing the principal components reveal an empirical structure consisting of two highly correlated factors ( $r=.56$ ), which explain 60.06% of total variance in answers. Such component items refer to *training impact on performance and attitudes*. However, taking the *scree plot* (Figure 1) and the high magnitude of bivariate correlation among components, they suggest that the scale has a predominantly unifactorial structure. For this reason, data were analyzed one more time by using the principal axis method (PAF, oblique rotation - *direct oblimin*), thus forcing the solution into one factor only. The scale has also been submitted to a reliability analysis (Cronbach's Alpha). A summary of such results can be found in Table 1.

Table 1 shows the results of such analyses in terms of items, descriptive statistics, factorial loadings and the Cronbach's Alpha value. A high level of reliability has been obtained and the items express the participant's perception of effects produced by training on performance and motivation at work. This factor explains 45.15% of the total variance in answers.

Table 1  
Empirical Structure of the Training Impact at Work - Green Format Factor ( $\alpha=.90$ )

Code	Description of Items	Loading	M	SD
Imp6	The quality of the work I do has improved.	0.79	3.67	1.00
Imp3	I make fewer mistakes at work.	0.76	3.61	1.10
Imp5	I do my work faster.	0.75	3.63	1.00
Imp9	My self-confidence has increased.	0.75	3.56	1.10
Imp8	My motivation for working has improved.	0.68	3.67	1.10
Imp7	The quality of the work I do has improved in tasks not related to the course.	0.67	3.15	1.10
Imp10	I suggest more frequent changes in work routine.	0.66	2.97	1.10
Imp1	I often make use of skills learned during training.	0.64	3.46	1.20
Imp11	I feel more receptive to changes.	0.63	3.27	1.10
Imp2	I take advantage of opportunities to practice my newly acquired skills.	0.62	4.10	0.90
Imp12	My workmates can learn from me.	0.61	3.09	1.10
Imp4	I can remember well the course content.	0.42	3.89	0.90

In a second phase, the data matrix was analyzed, thus forcing the analysis solution (PAF) in two factors, as it is suggested by the *scree plot*, format (see Figure 1). These two components explained 60.06% of total variance in answers and were highly correlated ( $r=.67$ ). The first scale (where  $\alpha=.86$ ) refers to training impact on performance and consists of 7 items (Imp3, Imp1, Imp6, Imp2, Imp5, Imp4, and Imp12), while the second scale refers to training impact on attitudes (where  $\alpha=.86$ ) and consists of 5 items (Imp11, Imp9, Imp8, Imp10, and Imp7) (Table 1). The two solutions reveal that both the unidimensional structure and the bidimensional one are useful, reliable, and valid. Therefore, depending on the evaluation purposes, they can be used altogether or separately.

#### Training Impact at Work Scale Validation - Blue Format

The answers provided by approximately 710 trainees to evaluation items on the Blue Format were submitted to the same statistical validation process used with the Green Format. As verified by KMO (0.94), the data matrix could be factorized.

The results of the analyses of the principal component indicate an empirical structure with two highly correlated factors ( $r=.60$ ), which explain 65.58% of total variance in answers. However, taking the *scree plot* (similar to Figure 1) as well as the high magnitude of bivariate correlation among components, a predominantly unifactorial structure can be observed. For this reason, data have been analyzed in two stages, by using the same techniques described in connection with the Green Format.

The results obtained from the analyses have shown that the empirical structure of the Blue Format is, when taken alone, almost identical to the one obtained with the Green Format. Table 2 presents the Blue Format Impact empirical structure and descriptive statistics.

It can be noted from Tables 1 and 2 that the internal consistency rate of items increased and that the relative position of some of them changed in scale when the second questionnaire was applied. This is true, for example, for items "Imp7" and "Imp10", whose relative importance was increased, and items "Imp1" and "Imp8", whose importance decreased when the second questionnaire was applied.

In a second stage, the data matrix was analyzed, and the analysis solution (PAF) was forced in two factors, as suggested by the *scree plot* format. These two components explained 59.02% of total variance in answers and kept a high magnitude correlation ( $r=.71$ ) among them. The first scale (where  $\alpha=.90$ ) refers to training impact on performance and consists of 7 items (Imp1b, Imp3b, Imp5b, Imp6b, Imp2b, Imp4b, and Imp12b), while the second scale refers to training impact in attitudes (where  $\alpha=.89$ ) and consists of 5 items (Imp11b, Imp9b, Imp8b, Imp10b, and Imp7b) (Table 2). The results confirm those obtained with the Green Format questionnaire, showing that the unidimensional and bidimensional empirical structures composing the *Training Impact at Work* scale have seemingly been consistent and stable.

A matched-samples t test, confirming the stability of measures for items constituting such structures, has revealed that after three months *Training Impact at Work*

Table 2  
Empirical Structure of the Training Impact at Work - Blue Format Factor ( $\alpha=0.93$ )

Code	Description of Items	Loading	M	SD
Imp6b	The quality of the work I do has improved	0.83	3.64	1.07
Imp3b	I make fewer mistakes at work	0.80	3.58	1.13
Imp5b	I do my work faster	0.80	3.56	1.10
Imp9b	My self-confidence has increased	0.78	3.49	1.14
Imp7b	The quality of the work I do has improved in tasks not related to the course	0.72	3.10	1.10
Imp10b	I suggest more frequent changes in work routine	0.72	2.93	1.08
Imp2b	I take advantage of opportunities to practice my newly acquired skills	0.71	3.99	0.93
Imp11b	I feel more receptive to changes	0.71	3.23	1.1
Imp8b	My motivation for working has improved	0.69	3,64	1,05
Imp12b	My workmates can learn from me	0.68	3.07	1.12
Imp1b	I often make use of skills learned during training	0.66	3,45	1,22
Imp4b	I can remember well the course content	0.51	3.71	0.94

self-evaluations were quite similar to the ones collected two weeks after course completion. However, two significant differences between such variable averages have been found - the first being related to the item "I can remember well the course content" (Imp4,  $t=5.41$ ,  $df=548$ ,  $p=.005$ ); the second being related to "I take advantage of opportunities to practice" (Imp2,  $t=2.41$ ,  $df=540$ ,  $p=.016$ ). In both cases, averages associated with such variables were significantly lower in the second application of the same items.

### Discussion

The evaluation questionnaire for *Training Impact at Work* presented in this paper can be used in research involving the global effects of training on trainees' behavior. The 1 2-item scale is more comprehensive than the bidimensional one with two sub-scales. Both are reliable structures, and both can be applied, depending on research purposes - to investigate the global impact of training on participants' behavior or on more specific impacts (on participants' productive performance or attitudes).

The unidimensional scale was used in a number of nation wide projects (Borges-Andrade, Azevedo, Pereira, Rocha, & Puente, 1999; Borges-Andrade, Gama, & Oliveira-Simões, 1999; see also Britto, 1999, e.g.). It had its empirical structure preserved and its validity confirmed in different organizational environments.

The present study has not validated a questionnaire for heteroevaluations of training impact at work. Greater objectivity and reliability of results would have been ensured if similar questionnaires had been used with supervisors or peers. Although the data collecting questionnaire has obtained fine validity and reliability rates, it needs improvement.

When he evaluated the courses offered by three Brazilian organizations with headquarters in the Federal District - a financial institution, an airport administration enterprise and a private telephone company - Meneses (2002) and Meneses and Abbad (2003) compared the empirical structure of self- and heteroevaluations of training impact at work using a scale similar to the one described in this study. The items in the heteroevaluation scale applied to supervisors and peers differ from the self-assessment items only by the facts that they were written using the third person and not the first one.

Concerning heteroevaluations scales of training impact at work, as seen by supervisors or peers, Meneses (2002) found factorial structures, in his research, that were very similar to the ones obtained in Abbad's (1999) impact self-evaluations.

The 12 items included in Meneses (2002) heteroevaluation scale of training impact explained 50% of the total variance of answers and reached a confiability index of 0,91. Similar results were issued from a different study led by Borges-Andrade and cols. (1999) in Banco do Brasil, referring to statistical validation of the impact heteroevaluation tool. The final scale had the same number of items (12) and explained 56% of the total variance of answers obtained, with a confiability index of 0,94. This is a demonstration of the scale stability. Posterior studies would make a correlation between self- and heteroevaluations of training impact at work and test the validity of the tool by using external criteria such as heteroevaluation or measurements of individual performance at work.

The aforementioned described results of factorial analysis have indicated that item "Imp4" (I can remember well the course content) is the one showing the lowest factorial loading in the selfevaluation scale of training impact. Abbad (1999) has made stepwise multiple regression analysis having trainees' answers to such item as a criterion variable and has found that most variables explaining retention (ability to remember content) were different from those found in training impact at work models, thus indicating that content retention, despite being correlated with impact, should not be mistaken with it.

Such differences in predicting the two variables - ability to remember content and impact - should be interpreted in the light of conceptual and methodological features involving the development of the measurement questionnaire used in this research. The first conceptual issue refers to the use of the expression ability to remember content in the questionnaire. In view of the way the statement has been made, the ability to remember content is neither a necessary nor a sufficient condition to transfer of training. Participants, for example, may not remember a content, but they may be able to put their newly acquired skills into practice at work. In some cases, participants can use them without the need to bring to mind all the theoretical content learned in the classroom.

Therefore, computer technology learners, for example, do not have to remember the software theoretical points taught by teachers in order to be prepared to make correct use of new procedures at work. In such cases, being exposed to teaching is not needed even to learn. This is true, not necessarily because imparted knowledge is not a formal prerequisite to learn how softwares should be used, but because the points that must be remembered are not verbal information on procedures, but behaviors, steps to be taken, and strategies involved in *knowing how to* complete the procedure.

Conversely, participants may remember content, but they may not know how to explain it. In such a case, not taking into account an eventual lack of adequate instructional planning, participants may be said to have learned *what*, but not *how*. Such trainees do not know how to *behave* the prescribed way. However, they can *say* what must be done.

In the context of *transfer* and *impact*, being able to *retain* is *knowing how* to do something after training is completed. Item "Imp4", which is used to measure retention, does not suggest the use of such concept. This variable would be more intensely correlated with impact, if the corresponding item were asked about the participants' ability to act in harmony with effectiveness standards and criteria taught during the course.

Referring again about the hypothetical example involving a computer technology course, trainees who have learned how to work out different tables, lines and fonts by using a word processor must remember steps and results of actions in order to reproduce them correctly in their work environment. Here, the expression "*ability to remember content*" does not seem adequate for two reasons. The first is that the questionnaire statement seems to refer only to trainees' ability to *say* things about the content, not to their ability to *make evident performance* learned during training. The second problem involves the idea beneath the object to be remembered. Item "Imp4" seems to have made participants to focus on the *content of theoretical explanations*.

In line with previously described conceptual analyses, the aforementioned item should check if, after training, participants *still knew how to do* the things taught during the course. But it did not. Apparently, the item seems to have limited the concept of retention to *being able to remember things said* by the instructor about course themes.

For such reasons, the concept of retention in research involving transfer of training and training impact at work should be better defined or even revised. A major benefit of redefining would be preventing confusions in the use of such concepts. Tracey, Tannenbaum and Kavanagh (1995), as well as, Rouiller and Goldstein (1993), for example, have confused retention with transfer. To measure transfer, both researches used measures based on instructional purposes, which, in a few instances, can measure - at the utmost - skill retention. The researchers ensured retention measure, but failed to include generalization and changes that skills acquired during training can suffer in the work environment.

Analyses have shown that *retention* is the direct effect of training measured in terms of participants' ability to perform actions learned during the course with the same level of competence that was evident in learning tests. *Transfer of training* is the application of such abilities in the work environment, while *training impact at work* involves measuring the effects of transfer of training on participants' performance and attitudes. Such revision would make room for a better understanding of cases in which retention and transfer were present, but not for a tangible impact of training on work performance.

In research in this area, learning and retention are measures revealing participants' performance in tests evaluating the extent to which instructional objectives have been reached, and they are usually applied at the end of courses. On the other hand, an evidence of retention would be noticed if, some time after training, participants were submitted to a test similar to the one applied at the end of the course and could obtain the same scores or similar ones. To prove that transfer of skill has taken place, participants should show that they knew how to use their new skills in their work environment, even in activities whose characteristics and demands are different from tasks used to evaluate short-term learning and retention. In this sense, transfer of training is the direct result of training involving maintenance (or long-term retention) and generalization, as Baldwin and Ford (1988) have suggested. Transfer of training, however, is not enough for training impact at work. There are other factors - such as those related to the psychosocial support to transfer that influence the *amplitude* of training impact on participants' performance and attitudes.

Solely applying new skills at work is no guarantee of visible effects on participants' global performance and attitudes. In order to provide evidence that training has produced positive effects on their work, participants should manifest relevant improvement in their products or work processes as well as changes in their attitudes.

The dispositional nature of performance learned during training would require a longitudinal assessment of its manifestations, so that long-term observation could be done in connection with the relation between new and old skills as well as with articulations between such abilities and the situations and environments surrounding them. This study has made possible only the analysis of training impact in two transversal samples. In the future, longitudinal sample research on impact needs to be done and an analysis of how

knowledge acquired during training articulates with the individual's previous experience should be made in order to ensure better performance. It seems also necessary to investigate possible unfavorable impacts of new knowledges on further performances of training participants.

Bransford and Schwartz (1999) claim that traditional studies in the area of transfer of training cannot explain how a set of pre-existing abilities (the use of word processors, for example) affect people's ability to learn a second set of similar abilities (the use of a different word processor, for example), because, traditionally, studies focus the effects of training solely on *knowing how* and *knowing what*.

In this context, longitudinal studies would also facilitate understanding the effects of training on *knowing what*, *knowing how* and *knowing with*. According to Bransford and Schwartz (1999), *knowing with* refers to the set of previous knowledge and experience accumulated by the individual from which he or she perceives, interprets and judges present and future situations. In this case, the different kinds of knowledge would not be independent. *Knowing how* would depend not only on the ability to interpret but also on the way the individual uses his or her previous experience (from *knowing with*). Also, for applying new skills in a smart, efficient way, the individual should develop metacognitive abilities to learn from new experiences and to adapt to the environment in order to be successful.

Additional studies need to be done to improve the way training impact at work is measured. A research agenda is suggested here and should include:

1. Developing and validating evaluation questionnaires of training impact at work that may contain specific items for long-term retention evaluation (based on instructional objectives, for example), general items for impact evaluation such as those in the questionnaire that has been described in this paper, in addition to these related to the amplitude of training effects on performance and attitudes.
2. Using heteroevaluations of training impact at work aiming at comparing them to selfevaluations, as well as examining eventual discrepancies or similarities.
3. Using a variety of data collecting methods including interview and observation in longitudinal investigations on the effects of training on the individual's behavioral repertoire at work.

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**Gardênia da Silva Abbad.** B. Sc. and Psychologist by the University of Brasilia (UnB), Brazil and M. Sc. and Doctor in Social and Organizational Psychology by the University of Brasilia (UnB), Brazil. She is a Full Professor at the Dept. of Social and Work Psychology, Institute of Psychology, UnB, where she does research, teaching (at the undergraduate, master and doctoral levels) and consulting services. Her areas of interest are learning in organizations, training, and development and organizational behavior. *E-mail:* gardenia@unb.br, gardenia@brturbo.com

**Jairo Eduardo Borges-Andrade.** B. Sc. and Psychologist by the University of Brasilia (UnB), Brazil, and M. Sc. and Ph.D. in Instructional Systems, by The Florida State University, Tallahassee, USA. He is a Full Professor at the Dept. of Social and Work Psychology, Institute of Psychology, UnB, where he does research, teaching (at the undergraduate, master and doctoral levels) and consulting services. His areas of interest are: training and development and organizational behavior. *E-mail:* jeborges@linkexpress.com.br

**Lúcia Henriques Sallorenzo.** Psychologist by the University of Brasilia (UnB), Brazil and M. Sc. in Social and Organizational Psychology by the University of Brasilia (UnB), Brazil. She is a Full Professor at the Dept. of Psychology, Catholic University of Brasilia (UCB), where she does research, teaching (at the undergraduate levels). Her areas of interest are learning in organizations, distance training and development and organizational behavior. *E-mail:* lucias@ucb.br