ASSESSING INFORMAL LEARNING STRATEGIES IN RESEARCH GROUPS

TRAINING PROGRAMS OF TOP BRAZILIAN PUBLIC FIRMS

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RESUMO

O fenômeno da aprendizagem no ambiente de trabalho tem sido objeto de grande interesse em estudos de pesquisadores e na aprendizagem informal, pois as estratégias de aprendizagem respondem por uma parte relevante no alcance de competências de pesquisa. Este estudo teve como objetivo adaptar uma escala de avaliação para esse fim, a fim de contribuir para a compreensão de como as estratégias de aprendizagem são aplicadas pelos participantes para o alcance de competências de pesquisa em grupos. Os dados foram coletados junto a integrantes de grupos de pesquisa cadastrados no CNPq e submetidos à estatística descritiva, análise fatorial exploratória e confirmatória (CFA) para validação da escala. As estratégias de aprendizagem foram agrupadas em cinco fatores (Reflexão ativa, Reprodução, Busca de ajuda nas relações interpessoais, Busca de ajuda em material escrito e Aplicação prática) e os resultados indicaram que o CFA teve ajustes próximos ao modelo empírico (CFI = 0,902; RMSEA = 0,80 e X2 / DF = 2,5) mas melhor que o modelo teórico, indicando que o instrumento pode ser aprimorado para atender a expectativa teórica.

PALAVRAS-CHAVE

Estratégias de aprendizagem profissionais. Análise fatorial. Análise fatorial confirmatória.

ABSTRACT

The learning phenomenon in workplace has been object of great interest in studies by researchers and informal learning, through learning strategies respond for a relevant part in research competencies achievement. This study aimed to adapt a evaluation scale for this purpose in order to contribute to understanding how learning strategies are applied by participants to achieve research competencies in groups. The data were collected from members of research groups registered in CNPq and underwent descriptive statistics, exploratory and confirmatory factor analysis (CFA) in order to validate the scale. Learning strategies were grouped in five factors (Active reflection, Reproduction, Seeking help through interpersonal relationships, Seeking help from written material and Practical application) and results indicated that CFA had adjustments near to the empirical model (CFI=0,902; RMSEA=0,80 e X2/DF=2,5) but better than theoretical model, indicating that the instrument can be improved to meet the theoretical expectation.

KEYWORDS

Professional learning strategies. Factor analysis. Confirmatory factor analysis (CFA).

INTRODUCTION

Research groups can be considered as teams and they are typically formed by performance units, who are responsible for training professionals and developing knowledge. They propitiate learning processes occurrence based on several learning strategies that result in skills acquisition (Antonello, 2006; Brandão, 2008). Researchers are looking to understand the way in which skills are acquired. For example, which strategies can people use to learn and which learned contents can be identified as competencies that were developed (Moraes & Borges-Andrade, 2010)? Nevertheless, it was not found studies that identify learning strategies used by research groups. In addition, (Puente-Palacios & Borba, 2009) point out that the scientific knowledge that explains the nature of teams functioning and how learning takes place in this context is still scarce and has not shown conclusive results.

Studies suggest the use of scales of learning strategies for identifying and inducing the use of certain learning strategies at work and improvement of certain aspects of organizational support to optimize the development and expression of managerial skills at work (Brandão & Borges-Andrade, 2011). Authors recommend further studies to verify the validated scale factor structure in other business segments or organizational roles.

This study aimed to adapt and validate a scale to measure learning strategies in research groups and to verify the perception of students and researchers registered in the CNPq Lattes platform (Brazilian research portal) regarding the frequency of use of learning strategies in research groups. The development of this scale is

particularly important for future research to verify whether the use of certain informal learning strategies could be associated with the field of competence related to research and also to productivity and performance in research groups.

THEORETICAL BACKGROUND

Research groups

In Brazil, among many activities, the National Council for Scientific and Technological Development (CNPq, 2011) organizes and provides information on the research groups in a digital directory accessible to all society. The goal, according to this organization, is to facilitate information exchange, in general and in academic and scientific community, preserving the memory of scientific and technological activity in the country. According to information in the official site of CNPq (2011):

Research group is defined as a set of hierarchically organized individuals around one or possibly two leaders: whose foundation organizer of this hierarchy is the experience, prominence and leadership in science or technology field; where there is professional and permanent engagement with the research activity; whose work is organized around common research lines; and that, to some degree, shared facilities and equipment. The group concept admits that consists of only one researcher. In almost all these cases, the groups are composed of the researcher and his students (CNPq, 2015). (http://lattes.cnpq.br/web/dgp/wiki recovered 20 May, 2015).

Despite CNPq politics accept at least one researcher as a research group to study purposes, the definition of a research group is "organized group of individuals hierarchically around one or two leaders: whose organizing foundation of this hierarchy is the experience and leadership in science or technology field of the leader; where there is permanent professional engagement with research activity; whose work is organized around common research fields; and, share facilities and equipment somehow. In research groups learning in a research takes place both formally planned and guided by the leader of the group, but predominantly by the existence of learning processes based on practice of common activities such as interaction and support between group members or queries, materials previously developed for shared problem solving (Cassell et al., 2009; Odelius et al., 2011). Learning reported by members of research groups can also be characterized as a social and knowledge creation process. In workplaces, informal learning is considered important because it characterizes collective processes of learning and knowledge sharing in groups and teams (Odelius et al., 2010).

Learning Strategies

Research that addresses learning strategies used by individuals at work comes from studies investigating informal learning processes at work. Learning strategies are understood as "information processing activities facilitating the acquisition, retention, retrieval and subsequent use of new information, which also encompass behaviors adopted by the individual, targeted learning and using new knowledge and skills" (Pantoja & Borges-Andrade, 2009, p.47).

Informal learning processes are described by the same authors as specific actions conditioned to the individual's interest and not systematically programmed. The absence of prior bond to results as well

as the absence of control over what should be learned by organization are some of its characteristics.

The strategies used in unstructured learning processes can be developed by people based on their own interest, motivation, time available and personal needs (Kanan & Marcon, 2012), context features and functions performed (Pantoja & Borges-Andrade, 2009), dynamic interaction and access to the accumulated knowledge in groups to which they belong (Odelius & Sena, 2009; Odelius et al., 2011) among other variables.

There are previous studies that validate scales of learning strategies in workplaces (Holman et al. 2001) and some of them have explored their relationship with: perception supports to lifelong learning (Pantoja, 2004); online distance training (Zerbini & Abbad, 2008; Zerbini et al,. 2005; Zerbini, 2003); organizational social climate and motivation for learning (Carvalho-Silva, 2008; Lopes-Ribeiro, 2005); organizational change (Beviláqua-Chaves, 2007); competency management (Brandão, 2009). Although above studies there were not found in literature researches concerning the relationship between researchers' areas of competence and learning strategies used by them to acquire those competences.

In order to contribute to the knowledge in this field of study this survey aimed to adapt a validated scale of learning strategies, based on studies that divides learning strategies in group contexts in two types: cognitive and behavioral strategies (Holman et al., 2001). In this study self-regulatory strategies proposed by Warr & Downing (2000) were not analyzed, because in the reviewed literature it was not found present consistent results confirming its association with learning success (Zerbini et al., 2005).

METHODOLOGY

In this research, a survey was conducted using questionnaires, analised first in qualitative way, through data content analysis. Then, a quantitative technique was applied through descriptive and multivariate statistics. The research is characterized as field survey as data were collected from university research groups (Richardson, 2010).

The objects of study are research groups registered in CNPq which have integral researchers with productivity scholarship. In June of 2012 there were 13,737 fellows spread over 22,897 research groups certified by universities or research organizations in the group's in which research activities occur (CNPq, 2011). The names of the researchers were identified in CNPq database, as well as their e-mails addresses. Invitations to answer the survey were sent to 5,575 researchers with productivity scholarship and it was asked to them to distribute the survey invitation to all members of the group, a procedure that will be detailed below.

The questionnaire was answered in the period from April to July of 2012 by 1,185 researchers of the groups but with the withdrawal of cases performed after analyzing the results of descriptive statistics and statistical assumptions, remained in the database 750 subjects.

The sample characterization in terms of gender, education, age and function shows that there was a balance between gender of the respondents. On the other side, vast majority of the sample (77.8%) hold at least a master degree, and nearly half (49.8%) are aged above 36 years. The func-

tion performed in the research group has a distribution comprising: teachers (40.3%), researchers (18.1%) and students (41.7%).

Regarding the origin of the respondents, data indicates vast majority of respondents are from public institutions (92.5%), distributed as follows: 6% from federal institutes (12 respondents), 14% from research institutes (43 respondents), 21% from private education institutions (56 respondents), 13% from state universities (143 respondents), and 37% from federal universities (496 respondents).

The instrument used for data collection was developed by Brandão & Borges-Andrade (2011). The adaptation was concerning the statement of the scales. Remained items content having been substituted by some terms to adjust them to assess activities in research groups (e.g. work changed to research; teams and areas of the organization have been changed to research groups; informative, booklets and company reports have been changed for theses, dissertations and articles etc.).

Instruments

The choice of the instrument used to assess learning strategies in research groups was done because it was the last one validated in Brazil. The scale developed by Brandão & Borges-Andrade (2011) was based on previous scales and have presented reliability above 0.78 is its validation. In the study the authors developed an instrument structure with five dimensions , named: Active reflection (AR) – relates to the individual's reflection about their work component parts as well as the organizational mental structures that relate one person work to different aspects of the organization (9 items); Reproduction (REP) – consists of items related to memory and mental information repetition without thinking about its meaning (4 items); Seeking help through interpersonal relationships (SIR) – refers to the individual active search for others the help (5 items); Seeking help from written material (SWM) – refers to research and information search in documents, manuals, regulations, books and other non-social sources (5 items); Practical application (PA) – refers to the individual's attempt to learn through experimentation, putting into practice their knowledge while learning (3 items).

The scale consists of 26 agreement items based on Osgood type scale. Items ranges varies from 0 to 10, in which 0 refers to less frequent use of the learning strategy (never do) and 10 represents more frequent use of the learning strategy (always do). The invitation to answer the study was made through electronic message and the questionnaire was published electronically using SurveyMonkey software. In the first section of the instrument there was the presentation of information relating to research, emphasizing the confidential, for the use of data; in the second, they asked to personal and functional data; and finally submitted to scale in which respondents should be noted the frequency of use of each strategy. In the invitation sent had the request that the researcher, in addition to responding to the instruments, also received message to forward it to the participation of members of the group of which they were part. This strategy sought to expand the sample, in order to include several participants of the same group and the scope of members with different profiles for research (researchers, graduate and undergraduate students).

Data analysis

The data collected from members of research groups were inserted in software Statistical Package for Social Sciences (SPSS), version 20. The first procedure performed was the analysis off suitability of the database to ensure the analisys quality. The database was submitted to descriptive and exploratory analyzes in order to verify the presence of extreme cases, omissions, the distribution of variables and sample size, as recommended by Neiva et al. (2011). Also, an analysis to identify the presence of outliers was performed and uni and multivariate normality was carried on, following theoretical recommendations (Hair et al., 2009).

Cases that did not bring data that could allow the institution identification or the research group (16 cases) and cases that brought only functional demographic information (124 cases) were excluded. For the treatment of missing data analyzed the percentage of responses per case. Cases with less than 50% of questions answered were also excluded (66 cases) resulting in a sample with 750 cases. It was believed that the high number of missing data should be led by the high number of instrument items. The univariate outliers were identified in 50 cases Z score, and using the Mahalanobis distance, 52 cases constituting multivariate outliers were also excluded. Excluding these cases, the resulting sample included 648 subjects.

For instrument analysis and validation it was performed descriptive statistics and exploratory factor analysis. To perform the exploratory factor analysis were observed the assumptions and recommendations of Laros (2008a) and Pasquali (2008), regarding: missing data, normal distribution of variables, presence of extreme cases, sample size, multicollinearity, factorability and array reliability.

The variation coefficients (standard deviation divided by the mean) of the variables were greater than 0.001 and do not suggesting necessary changes. In addiction, the lack of normality of the variables did not cause a problem in the factor analysis (Laros, 2008b), since the technique is fairly robust to violations according the assumption of Neiva et al. (2011).

After that, the linearity of the relationship between variables was checked, examining the magnitude of correlations between pairs of items. This analysis generally indicated the presence of linear association between the variables verified, two by two, with peer relationships presented intensities greater than 0.9 and none of these variables excluded from the analysis by the presence of multicollinearity (Laros, 2008a).

The principal components analysis was used for the initial estimated number of factors. Then, based on responses to 26 items of the survey, it was extracted the matrix of correlations between variables and held the principal components analysis (PCA). After the factors extraction, Cronbach's alpha was extracted to measure internal reliability of the instrument. Due to the results we found there was the Confirmatory Factor Analysis (CFA).

RESULTS

Exploratory factor analysis

The procedure performed in order to obtain statistical validation was the use of data from a first moment data collection in which a total of 358 responses were obtained and underwent exploratory factor analysis in order to observe the adherence of the survey instrument to the proposed

objective. The Bartlett´s sphericity test resulted in a KMO (Kaiser-Meyer Olkin) of 0.93. This result according to Pasquali (2008) suggests an excellent factorability. The factorial matrix was extracted according to the recommendations (Field 2009), through the PAF method (Path axis factoring) and applied oblique rotation as suggested by Pasquali (2008). Cronbach's alpha was calculated (Hair et al. 2009) to analyze the internal reliability of each factor and the lowest value was 0.79 for the reproduction factor. The highest value was 0.90 for Active reflection, so the values were considered satisfactory (Fidell et al., 2009).

Confirmatory factor analysis

The second data collection with 380 responses were underwent to the confirmatory factor analysis in order to verify the robustness of the instrument (Byrne 2009). The indexes found where: CFI = 0.90, RMSEA = 0.80 and X^2 / gl = 2.5. Those results satisfactorily meet the set requirements (Marôco, 2010), indicating model fit. Figure 1 shows the confirmatory analysis empirical model and the theoretical construction of the items related to the factors.

The research goal was to confirm the instrument fitting and its ability to explain the phenomenon is interesting to see whether the theoretical structure of items is different from the empirical structure and thus compare the two models watching, which showed the best fitting results (Marôco, 2010). The theoretical construction of the items in relation to the factors, the results showed worsening in the indexes (CFI = 0.89 = 0.81 and RMSEA X^2 / GL = 2.57), indicating that the empirical model has near fittings, though even better than the theoretical model.

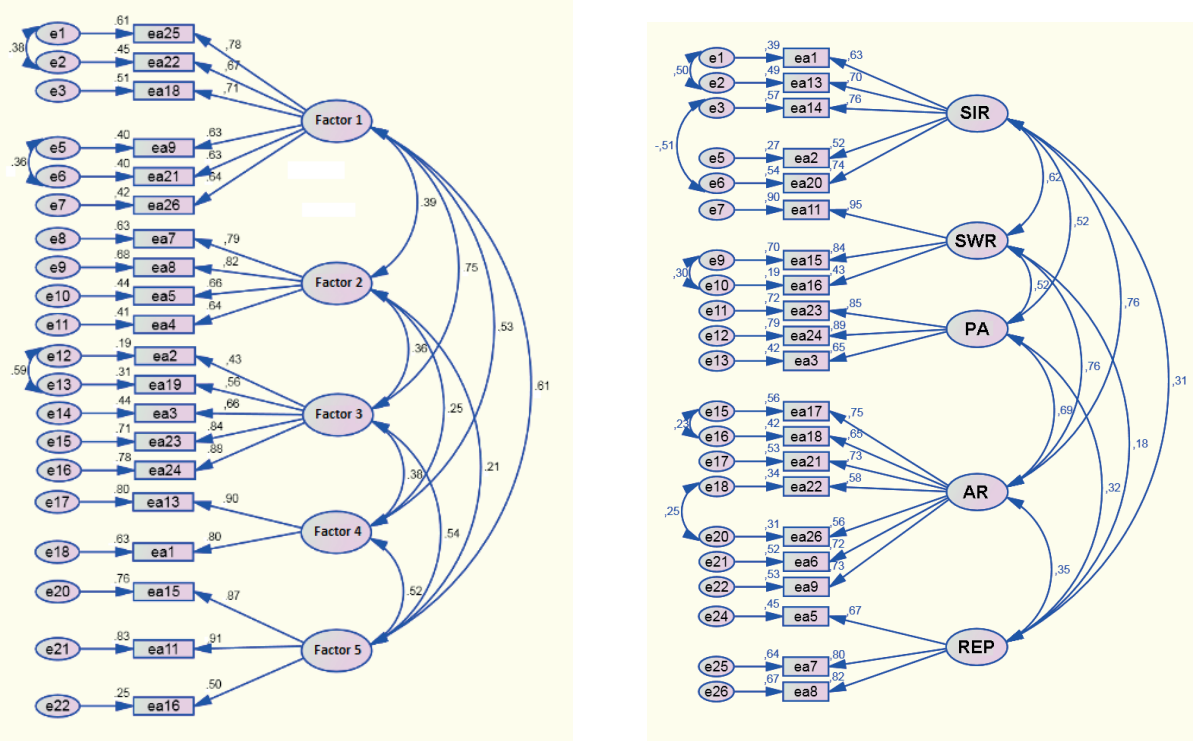

FIGURE 1 – Empiric Model and theoretical construction

Source: research data.

CONCLUSIONS

In the scale developed to measure Learning Strategies the variables related to individual reflection (intrinsic) and organization's mental structures work-related (extrinsic) were also gathered by a factor named by authors as Active reflection (Brandão & Borges-Andrade, 2011).

Comparing studies results regarding the evaluation of the dynamics of learning in research groups (Odelius et al., 2011) it was possible to identify similarities in first factor group. For both the transmission activities of knowledge of the more experienced to less experienced as the shared problem solving there were identified the use of learning strategies, but there have been no records of breeding strategies. In contrast to studies related to learning methods used for the acquisition of qualitative research skills (Cassell et al., 2009) there were found activities related to self-regulatory strategies such as time dedicated to the development and prolonged engagement research activities.

The aim of this study was to identify learning strategies used in operations in research groups and the exploratory factor analysis revealed correlation patterns between these strategies and the existence of underlying dimensions to them. The five primary factors extracted in the exploratory factor analysis proved valid – due to good factor loadings of its items (all above 0.40) – and internally consistent, since their alphas showed up or equal than 0.79. This indicates good levels of reliability of the component variables of each factor. The results of confirmatory factor analysis also showed good results.

In later studies, the use of only factor scores for each respondent (the five factors) and not the scores on the components of the scale items could be done. Such as primary factors relate to each other, constitute sub-factors of a factor of second order, which also showed good internal consistency and good items with factor loadings, which represent sources of evidence for its validity. The factor score of that one factor could also be used in later investigations, representing the construct learning strategies in research groups, although the use of four primary factors to better exploit the major components of this construct.

The method used to carry out this research imposes some limitations on its results. The use of non-probability sample may have underestimated the variety of population members, bringing limitations on the representativeness of the data. There is no guarantee that the judgments made by participants representing reliable indicators of actual use of learning strategies, as estimates based on self-report may contain inaccuracies, errors halo and other biases. It is believed that these potential limitations, although they can restrict the results do not invalidate the present investigation, because this has exploratory.

Considering the relative scarcity of empirical research, it is expected that the validation of the scale may give rise to new studies. Using the scales, organizations and researchers could devote to, for example: (A) identify which personal characteristics (such as age, gender, role in the group, time of experience in research, for example) influence the use of learning strategies in terms of group productivity; (B) examine the extent and characteristics of the existing research group conditions (such as organizational

climate, support learning, group dynamics, for example) and characteristics and nature of the research (as used processes and technologies) influence learning strategies employed and results, in terms of group productivity; (C) verify to what extent the field of competence influences the performances of individuals and research groups; (D) identify the participation of groups from different areas of knowledge results in different learning strategies; (E) identify the participation in research groups of the same area with different research objectives, results in different learning strategies.

In the case study of an emerging topic, it is expected that this study has provided methodological contribution to the data collection instrument validation concerning learning strategies research group.

It is recommended to continue the research with the collection of attendance data, since the fact been carried out by electronic means may have led to participation only groups with a specific profile, favorable to the use of technology. It also suggests the identification of groups that have specific characteristics (constitution by experienced researchers or working in collaboration network) to greater understanding of the learning process phenomena in research groups, as well as evaluating the overall discriminating capacity of the scale.

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