Scale to Assess Leaders' Perceptions about their Workers' Digital Addiction

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Original Article

Abstract

Background: With the evolution of technologies and the mobility factor, new digital devices have emerged, influencing human behavior and provoking diverse dependencies due to their abusive use. Collective environments begin to exhibit the symptoms of such dependencies, compromising people's quality of life (QOL). The objective of the present study was to validate the scale to evaluate the perception of leaders on digital employee addiction (EPLDDE) initially with 17 questions.

Methods: The scale was constructed with real situations of digital addiction and through the evaluation of the semantic comprehension and consistency of the items by judges until final formatting of the instrument. Data collection was done via the internet. The sample consisted of 312 volunteers from a federal state-owned company. After data collection, a database was created for statistical analysis. Statistical program R was used.

Findings: Bartlett's and Kaiser-Meyer-Olkin (KMO) tests confirmed adequacy for factorial analysis. Three statistical criteria were used, and scree plot presented adequate commonalities indicating 5 factors and the withdrawal of 3 questions from the scale. In the second AF, results ratified 14 questions. Cronbach's alpha showed a positive result of 0.8131717.

Conclusion: The 14-item EPLDDE scale was validated for the evaluation of the perception of leaders regarding digital dependence of employees in organizations. This scale can contribute to studies on organizational QOL. The limitations found did not compromise the results.

Keywords: Addiction digital; Organizations; Companies; Employee; Leaders

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Introduction

Digital Addicition[1] is the lack of autonomy or independence to perform tasks without the use of digital devices such as mobile devices and tablets, and the Internet, social networks, and the like.[1] The lack of these resources, even temporarily, can generate anxiety,[2] fear, and insecurity, preventing the individual from carrying out his activities normally. Nomophobia[3] is an example of digital addiction, as well as digital amnesia, attention deficit disorder (ADD), digital dementia, abusive use of social networks, and committed vision among other dysfunctions.[1]

Recent literature has explored the process of global change associated with social, technological, and timesaving relationships, as well as the relation of time of entry and exit. Thus, social practices are changing and new ones are being created due to technologies.[4]

The mobility factor, materialized by the integration of the internet and cell phones, contributes to greater digital use, transforming human behavior. This transformation derives from abusive use[5] that can have harmful effects on health, requiring care to minimize physical, psychological, and behavioral damages.[6,7]

The negative impacts of these changes are caused by the abusive use of the Internet, affecting quality and performance in work and academic achievement, family life, social relations, physical health, and psychological well-being.[8]

Internet addiction represents a global health issue. Efforts have been made to characterize risk factors for the development of this dependence and the consequences of excessive use of the Internet. This feature has dramatically changed the way we live, and we find our way into unfamiliar territory, communicating effectively with our friends, facilitating professional communications, and promoting collaborative science with investigations around the world.[9]

In addition to Internet dependence as it has been originally studied, dependence on social networks and communication applications has also been researched.[10]

Behavioral and psychological changes are related to abusive and uncontrolled use, which have severe impacts on users' lives.[11]

The expansion of the digital age extrapolated this dependency at the individual level into a social phenomenon given its collective and broad characteristic and even influenced organizational environments, hitherto not contemplated.[1]

Employees' abusive, indiscriminate use in work environments may be detrimental to quality of life (QOL), individual performance, and collective organizational outcomes. In this scenario, leaders need to understand this phenomenon and work towards preserving QOL in the workplace.

Checking emails at work after hours, logging into social networks or personal emails while working, and increasing connectivity particularly with the proliferation of handheld devices can have negative consequences in personal and professional domains. Distinctions between work and leisure, public and private, here and there are rapidly disappearing, while the stress reported as caused by the abusive use of technology seems to be growing.[12]

The hypothesis is that abusive use of digital technologies in organizations can lead to the establishment of digital addiction. Thus, leaders need to identify this phenomenon. To do this, it is necessary to measure these events in human behavior using a specific validated scale.

This work aimed to validate the scale to evaluate the perception of leaders on digital employee dependence (EPLDDE) built specifically for application among people holding positions of leadership in organizations. The recognition of this dependency among its employees can help an organization take action to preserve or increase QOL at work.

Methods

No digital addiction scales were found in organizations that could subsidize the construction of this scale. Due to the novelty of the theme, which leads to the production of new knowledge, no restriction was placed on the date of the valid contents or on the nationalities of the authors of the contents to be investigated. The keywords used in the search were digital addiction in organizations digital addiction on companies, digital addiction in employees, perception of leaders about digital addiction.

Initially, different situations that could characterize digital addiction in organizations such as excessive use of particular mobile devices were related by digital addiction specialists of the Delete-Conscious Use of Technologies group,

Federal University of Rio de Janeiro (IPUB/UFRJ). Motivation due to organization rules on use of mobile devices, which limited internet access, affected interpersonal relationships and affected organizational outcome. Then, items related to these situations were described through phrases that could reflect the mentioned behaviors reported in the literature as well as in the interviews conducted with potential digital dependents by the Delete Nucleus. This stage was aimed at apprehending people's perceptions of digital dependency and how it occurs in practice in organizations.

A first version (20 questions) was constructed in scale format with items in the interrogative form, with multiple choice questions scored on a 3-point scale ranging from 0 to 2 [Never/Rarely (0), Often (1), and Always (2)].

The elaborated items were tested to verify the semantic understanding and the scale was presented to 10 people with a profile analogous to the target audience. They were instructed to carefully read each item and try to identify comprehension difficulties. The impressions of this group were openly debated, and based on them some questions were semantically adjusted.

After the semantic comprehension tests, the consistency of the questions was evaluated by a group of 6 judges, teachers, and doctors who examined clarity, objectivity, and focus of the questions in terms of the research objectives. The judges had to reach an agreement on each item or change it. The contributions of these judges were evaluated one by one, with no face-to-face debate, and the criterion of at least 80% agreement between these judges was adopted, concluding with the withdrawal of 3 questions, and thus, resulting in a scale of 17 questions.

The target audience consisted of 786 heads (departments, managers division, sector, and coordination) of the Brazilian state-owned company of Information and Communication Technology.

The sample consisted of 340 volunteers of both sexes and aged between 18 and 65 years, generating the excellent participation percentage of 43.2% (340 of 786 guests). The final sample consisted of 312 volunteers, due to filling errors.

The data collection took place online during 30 days, with a link exclusively for volunteers. The answers were compiled in a database for statistical analysis in an orthogonal model, with varimax rotation, for scale validation, composed of descriptive statistics, factorial analysis, and internal consistency, using the R[13] software (version 3.4.2) [Bell laboratories (now Lucent Technologies)], packages dplyr,[14] psy,[15] and paran.[16]

Even after discarding 28 questionnaires, the percentage of participation was very good (41%), fully attending the list of 5 respondents per question.[17]

The inclusion criteria were as being in exercising leadership positions as well as legal age. The exclusion criteria were as being non-boss and outsourced employees. So, 786 participants entered the study.

Results

Data: There were errors in completing the data by the volunteers; a total of 28 questionnaires in the data table contained errors. They were withdrawn from the sample; reducing the 340 participants to 312, a very good quantity for a questionnaire with 17 questions.

Descriptive statistics: For each demographic characteristic, the absolute numbers of elements with the proportion within their group are presented (Table 1).

Table 1. Descriptive Statistics

Sample descriptive statistics	Value [n (%)]	
Gender	Male	Female
	225 (72.1)	87 (27.9)
Age range (year)		
26-35	30 (13.3)	6 (6.9)
36-45	108 (48.0)	43 (49.4)
46-55	51 (22.7)	26 (29.9)
> 55	36 (16.0)	12 (13.8)
Education		
Middle	9 (4.0)	2 (2.3)
Higher	57 (25.3)	15 (17.2)
Specialization	139 (61.8)	63 (72.4)
Master	19 (8.4)	7 (8.0)
Doctorate	1 (0.4)	0 (0)
WI	0 (0)	0 (0)

WI: Without information

The quantitative difference between participants of each gender did not affect the scale validation objective.

In terms of educational level, there is no perceptible difference between the groups, except for the "Doctorate" group, with only one

element, which makes it not significant for some mean test.

Factorial analysis:[15] Two factorial analyses were performed, the first with data of 17 questions where they were found.

Bartlett's sphericity test:[15] The first was the Bartlett test to verify if the variables are correlated, which will ensure consistency of the set. In this test, the null hypothesis is that the correlation matrix is equal to the identity matrix. For the data set, a statistic equal to 1540.351 was found. It can be verified that factorial analysis can be done due to the low P-value found (P < 0.01), indicating a correlation between the variables.

Kaiser-Meyer-Olkin Test:[15] The next test to verify the adequacy of the factorial analysis was the Kaiser-Meyer-Olkin (KMO) correlation matrix. The found value of 0.8060948 is considered appropriate.[16] The measure of sampling adequacy (MSA) indices for each question were extracted. Only one question (question 13) presented a value below 0.7. The other questions presented values higher than 0.7, a very positive result, illustrating the correlation between the questions.

The results of Bartlett's test and KMO indicated that it is appropriate to perform factorial analysis.

Factorial loads: Factorial loads, estimated by principal components analysis (PCA), were determined in order to determine the number of factors and the need to discard scale questions, using the 3 criteria of factorial load, scree plot, and parallel analysis for comparison purposes. The correlation matrix was based on the Spearman correlation (Table 2).

Factorial load criterion: The use of factorial loads with accumulated ratio of greater than 0.9

and, in the worst case, above 0.8 is recommended. However, for the data set, we would have to use at least 10 factors, as a result from PC10, which would not solve the problem of data reduction.[16]

Scree plot criterion: In the scree plot of the correlation matrix, factors related to eigenvalues of greater than 1 were eliminated. Figure 1 presents the results by this criterion.
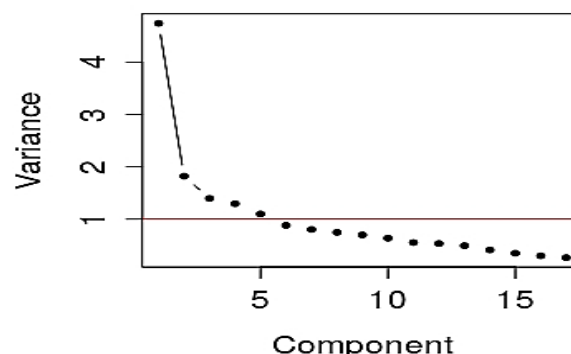

Figure 1. Scree plot chart of the correlation matrix

As shown in figure 1, based on this criterion of the correlation matrix, 5 factors must be used because they have variance of above 1. In this case, the commonalities of the variables are presented in table 3.

Five questions (1, 5, 14, 15, and 16) should be excluded because they present commonalities of less than 0.5, as highlighted in table 3. Questions 1 and 5, however, were maintained given their importance for understanding the phenomenon of digital dependency and its alignment with the research objectives.

Parallel analysis criterion:[16] Based on this third criterion, 4 factors were found, with the suggestion

Table 2. Factorial loads of the principal components

Factorial loads						
	PC1	PC2	PC3	PC4	PC5	PC6
Standard deviation	2.178	1.349	1.181	1.137	1.048	0.938
Proportion of variance	0.279	0.107	0.082	0.076	0.065	0.052
Accumulated ratio	0.279	0.386	0.468	0.544	0.609	0.661
	PC7	PC8	PC9	PC10	PC11	PC12
Standard deviation	0.895	0.864	0.835	0.796	0.742	0.730
Proportion of variance	0.047	0.044	0.041	0.037	0.032	0.031
Accumulated ratio	0.708	0.752	0.793	0.830	0.862	0.894
	PC13	PC14	PC15	PC16	PC17	-
Standard deviation	0.701	0.640	0.589	0.546	0.512	-
Proportion of variance	0.029	0.024	0.020	0.018	0.015	-
Accumulated ratio	0.923	0.947	0.967	0.985	1.000	-

PC: Principal components

Table 3. Communality with 5 factors

EPLDDE 1	EPLDDE 2	EPLDDE 3	EPLDDE 4	EPLDDE 5	EPLDDE 6
0.492	0.618	0.693	0.725	0.437	0.603
EPLDDE 7	EPLDDE 8	EPLDDE 9	EPLDDE 10	EPLDDE 11	EPLDDE 12
0.780	0.745	0.712	0.779	0.644	0.547
EPLDDE 13	EPLDDE 14	EPLDDE 15	EPLDDE 16	EPLDDE 17	-
0.544	0.450	0.452	0.469	0.661	-

EPLDDE: Evaluate the perception of leaders on digital employee addiction

to withdraw 8 of the 17 questions, which would compromise the consistency of the scale.

Internal consistency-Cronbach's alpha: The last step was to calculate Cronbach's alpha[17] to determine the internal consistency of the questionnaire. The value found was 0.8270347, which illustrates consistency between the questions in the questionnaire.

Second factor analysis: Statistical analyzes were repeated without questions 14, 15, and 16.

Bartlett's sphericity test: A statistic equal to 1308,916 was found. It is verified that factorial analysis can be performed due to the low P-value (P < 0.01), indicating a correlation between the variables.

KMO: The new KMO with 14 questions was 0.7893884, slightly smaller than the first data analysis with 17 questions, because even the low correlations of the questions withdrawn contributed to the higher KMO of the questionnaire.

The MSA indices were extracted from the KMO for each of the 14 questions, where only two questions presented values below 0.7 (questions 1 with 0.629 and 13 with 0.589), confirming the correlation between the questions.

Factorial loads: Factorial loads were verified for 14 questions, again indicating 5 factors. Thus, without the withdrawal of questions, 14 questions remained (questions 1 to 13 and 17) (Table 4).

Thus, there are 5 factors, where factor 1 contains the questions 5, 9, 10, 11, and 17, factor 2 contains 12 and 13, factor 3 contains 6, 7, and 8, and factor 4 contains 3 and 4. Moreover, factor 5 is formed by questions 1 and 2.

The accumulated variance of 0.678, highlighted in table 5, shows that the 5 factors explain 67.8% of the questionnaire.

The following scree plot graph ratifies 5 factors, as shown in figure 2.
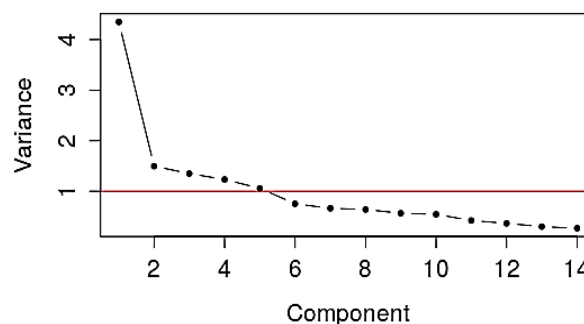
Figure 2. Scree plot chart of the correlation matrix

Table 4. Five factors according to factorial loads

Number of EPLDDE	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Communalities
1	-0.041	-0.336	-0.015	-0.095	0.757	0.697
2	0.127	0.009	0.126	-0.148	0.777	0.657
3	0.127	-0.050	0.093	-0.800	0.156	0.694
4	0.179	0.001	0.142	-0.828	0.072	0.742
5	0.436	0.109	0.309	-0.065	0.432	0.489
6	0.163	0.091	0.695	-0.277	0.101	0.600
7	0.183	-0.101	0.520	-0.048	0.136	0.790
8	0.125	-0.124	0.844	-0.026	0.007	0.744
9	0.803	-0.085	0.169	-0.620	0.040	0.708
10	0.854	-0.109	0.092	-0.100	0.088	0.767
11	0.731	-0.264	0.270	-0.157	-0.042	0.646
12	0.297	-0.611	0.104	0.011	0.349	0.594
13	0.040	-0.851	0.050	-0.040	0.014	0.731
17	0.598	0.284	0.232	-0.048	0.357	0.622

EPLDDE: Evaluate the perception of leaders on digital employee addiction

Table 5. Factorial loads and variance ratio for the 5 factors

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Factorial load	2.687	1.428	2.181	1.507	1.682
Proportion of variance	0.192	0.102	0.156	0.108	0.120
Accumulated ratio	0.192	0.294	0.450	0.557	0.678

Cronbach's alpha:[17] New alpha of Cronbach, was found to be 0.8131717, considered as good and illustrating consistency between the questions of the questionnaire.

Calculating Cronbach's alpha for each of the 5 factors yielded 0.79 for factor 1, 0.53 for factor 2, 0.77 for factor 3, 0.61 for factor 4, and 0.57 for factor 5.

Discussion

There is a commitment in the personal, social, academic, and professional life of volunteers with abusive use and/or dependence on digital technologies in daily life.[18]

Digital addiction has grown in organizations without the perception of its leaders, who are not prepared to identify and understand this phenomenon, which interferes in human behavior in the organizational environment, and consequently, in culture, performance, and expected results.[1]

Digital addiction has a collective global dimension reaching communities, cities, nations, and organizations constituting a social fact, by its breadth, characterized by the transformation of the whole community and its culture. Thus, it is justifiable to construct an instrument, such as the EPLDDE scale, that can assess the degree of digital addiction in organizations.

Demographic data showed a good frequency, revealing consistent degrees of comprehension for the items in the scale, as well as a good frequency distribution by age group of participants, especially in the age groups of 31-40, 41-50, and 51-60 years. Satisfactory variability that minimizes the tendency of only one predominant group creates research bias.

The factorial analysis was performed due to the low P-value in Bartlett's sphericity test, indicating a correlation between the variables. In addition, by the KMO criterion, the adequacy of the factorial analysis was ratified with 16 of the 17 items of the scale with values above 0.7, which is a very satisfactory reference. The only item below 0.7 showed a value of 0.675, so very close to 0.7 that it signifies a good result.[13] In the second

factor analysis in the questionnaire with 14 questions, both Bartlett's test and the KMO indicated the accomplishment of said analysis.[14]

Three criteria were used to choose the number of factors in the first factorial analysis, factorial load, screeplot, and parallel analysis, with a more appropriate number of factors (screeplot with 5). In the second factorial analysis, the 5 factors and 14 issues were maintained.

Only question 5 presented a commonality below 0.500 (0.489), highlighted in table 4. It is not a satisfactory result, but this question is very important for the research objectives, and thus, is kept in the questionnaire.

The internal consistency was evaluated using Cronbach's alpha,[17] which presented a value of 0.8131717 that ratifies the alignment between the scale questions, since values above 0.7 are considered valid, thus, reinforcing the adequacy of the scale. The Cronbach's alpha of each of the 5 factors was also extracted, with the expectation that they were smaller than the general one, due to the small number of questions for each factor. In this way, factors 1 and 3 (0.79 and 0.77) reached the level of 0.7, which is considered satisfactory, while factors 2, 4, and 5 had a value of 0.53, 0.61, and 0.57, respectively. These internal consistency values should be improved through reviewing each of the items or questions, although Cronbach's alpha for the overall questionnaire with 14 questions was good.

Among the limitations, which did not affect the achievement of the objectives, the novelty of the theme stands out. Bosses, being also employed, even knowing that the data would be treated collectively, may be mistrustful about the fate of their answers. The online application prevents a reading of the reactions of the volunteers during responding. In spite of all this, effective and efficient management was possible through the coordination of the organization that served as research field.

Conclusion

After the judicious process of constructing the scale based on the knowledge about digital

dependence and the analyses of semantic comprehension and consistency of the items based on judges' views, the data generated from the application of the scale in a final sample of 312 leaders were analyzed statistically. Two factorial analyses determined the finalization with 14 questions, validating the EPLDDE scale for the evaluation of leaders' perceptions about the digital dependence of employees in organizations. It is important to build a specific instrument such as this to meet the needs of future scientific research in the field of organizational digital addiction because the growth of this theme and its interference in organizational culture, human behavior, and the operation of organizations justifies this endeavor.

It is necessary to expand investigations on this phenomenon to make the data more consistent, allow comparisons between organizations researched, and to support the leaders' performance in the better coexistence of their teams with digital dependence, which may present different characteristics according to the various groups of organizational profiles.

Conflict of Interests

The authors have no conflict of interest.

Acknowledgements

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مقیاس ارزیابی درک مدیران در مورد اعتیاد دیجیتالی کارمندان

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مقاله پژوهشی

چکیده

مقدمه: با تکامل تکنولوژی‌ها و عامل جابه‌جایی، دستگاه‌های دیجیتال جدیدی به وجود آمده‌اند که سوء استفاده از آن‌ها بر رفتار انسان تأثیر می‌گذارد و وابستگی‌های مختلفی را پدید می‌آورد. محیط‌های جمعی، علایم چنین وابستگی‌هایی که کیفیت زندگی افراد را به مخاطره می‌اندازد، نشان می‌دهد. هدف از انجام پژوهش حاضر، بررسی روایی مقیاس ارزیابی درک مدیران در مورد اعتیاد دیجیتالی کارمندان (Evaluate the perception of leaders on digital employee addiction یا EPLDDE) بود که در ابتدا از ۱۷ سؤال تشکیل شد.

روش‌ها: مقیاس با موقعیت‌های واقعی اعتیاد دیجیتالی درک معنایی و از طریق ارزیابی درک معنایی و انسجام سؤالات توسط داوران تا قالب‌بندی نهایی طراحی و سپس داده‌ها با کمک اینترنت جمع‌آوری شد. نمونه‌ها شامل ۳۱۲ داوطلب از یک شرکت دولتی فدرال بود. پس از جمع‌آوری داده‌ها، یک پایگاه داده‌ها برای تجزیه و تحلیل آماری به وجود آمد. برنامه آماری R مورد استفاده قرار گرفت.

یافته‌ها: آزمون‌های Bartlett و Kaiser-Meyer-Olkin (KMO) کفایت تحلیل عاملی را تأیید کرد. سه معیار آماری استفاده گردید و نمودار سنگریزه مشترکات کافی را نشان داد که دلالت بر ۵ عامل و حذف ۳ سؤال از مقیاس داشت. یافته‌های تحلیل عاملی دوم، ۱۴ سؤال را تأیید نمود. آزمون Cronbach's alpha نتیجه مثبت ۰/۸۱۳۱۷۱۷ را نشان داد.

نتیجه‌گیری: مقیاس ۱۴ سؤالی EPLDDE برای ارزیابی درک مدیران در مورد وابستگی دیجیتالی کارمندان در سازمان‌ها مورد اعتبارسنجی قرار گرفت و تأیید شد. این مقیاس را می‌توان در مطالعاتی پیرامون کیفیت زندگی سازمانی به کار برد. محدودیت‌های یافت شده اختلالی در نتایج ایجاد نکرد.

واژگان کلیدی: اعتیاد دیجیتالی، سازمان‌ها، شرکت‌ها، کارمند، مدیران

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