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Escala de saúde psicológica adaptada e validada no contexto de doutorado

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Article abstract

Despite the growing number of studies on the psychological health of doctoral students, interest seems to be focused on their psychological distress. This may be due to the lack of available tools contextualized to doctoral work to measure both psychological distress and well-being, which represent two indissociable aspects of psychological health. Since such a tool appears essential for future empirical research that will attempt, for example, to clarify the predictors and consequences of this construct, the present study aimed to adapt an existing work- related psychological health scale (Gilbert et al., 2011) into a short, doctoral- contextualized version, and to examine its psychometric qualities. Four indicators of construct validity (exploratory, confirmatory, convergent, and predictive) and two indicators of reliability (internal consistency and temporal stability) were examined among two samples including 380 and 377 doctoral students, respectively. A short unidimensional scale comprising eight items (four items measuring the distress pole and four items measuring the well-being pole) with good psychometric qualities was obtained, supporting its use in future studies.

Échelle de santé psychologique adaptée et validée au contexte doctoral[1]

Adapted and validated psychological health scale in the doctoral context

Escala de saúde psicológica adaptada e validada no contexto de doutorado

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Key words: doctorate, psychological distress, psychological health, psychological well-being, scale development, scale validation

Despite the growing number of studies on the psychological health of doctoral students, interest seems to be focused on their psychological distress. This may be due to the lack of available tools contextualized to doctoral work to measure both psychological distress and well-being, which represent two indissociable aspects of psychological health. Since such a tool appears essential for future empirical research that will attempt, for example, to clarify the predictors and consequences of this construct, the present study aimed to adapt an existing work-related psychological health scale (Gilbert et al., 2011) into a short, doctoral-contextualized version, and to examine its psychometric qualities. Four indicators of construct validity (exploratory, confirmatory, convergent, and predictive) and two indicators of reliability (internal consistency and temporal stability) were examined among two samples including 380 and 377 doctoral students, respectively. A short unidimensional scale comprising eight items (four items measuring the distress pole and four items measuring the well-being pole) with good psychometric qualities was obtained, supporting its use in future studies.

Mots clés : bien-être psychologique, détresse psychologique, développement d'outil, doctorat, santé psychologique, validation d'outil

Malgré le nombre grandissant d'études sur la santé psychologique des doctorants, l'intérêt semble surtout axé sur leur détresse psychologique. Ceci peut s'expliquer par le manque d'outils contextualisés au travail doctoral pour mesurer à la fois la détresse et le bien-être psychologiques, deux aspects indissociables de la santé psychologique. Or, un tel outil apparaît essentiel pour les futures recherches empiriques qui tenteront, par exemple, d'éclairer les prédicteurs et les conséquences de ce construit. La présente étude visait donc à adapter une échelle existante de santé psychologique au travail (Gilbert et al., 2011) en version courte et contextualisée au doctorat et à examiner ses qualités psychométriques. Quatre indicateurs de la validité de construit (exploratoire, confirmatoire, convergente et prédictive) et deux indicateurs de fidélité (cohérence interne et stabilité temporelle) ont été examinés sur deux échantillons de 380 et 377 doctorants. Une courte échelle unidimensionnelle à huit items (quatre items mesurant le pôle de la détresse et quatre items mesurant le pôle du bien-être) présentant de bonnes qualités psychométriques a été obtenue, justifiant son utilisation dans des études ultérieures.

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Palavras-chave: bem-estar psicológico, desenvolvimento de ferramenta, doutoramento, saúde psicológica, sofrimento psicológico, validação de ferramenta

Apesar do crescente número de estudos sobre a saúde psicológica de doutorandos, o interesse parece estar centrado principalmente no seu sofrimento psicológico. Isto é devido provavelmente à falta de ferramentas disponíveis adaptadas ao trabalho doutoral para medir simultaneamente o sofrimento e o bem-estar psicológicos, que representam dois aspectos indissociáveis da saúde psicológica. No entanto, tal ferramenta parece essencial para futuros estudos empíricos que poderão, por exemplo, esclarecer os preditores e as consequências deste constructo. O presente estudo teve, portanto, como objetivo adaptar uma escala de saúde psicológica no trabalho (Gilbert et al., 2011) em versão curta e adequada ao doutoramento e examinar suas qualidades psicométricas. Quatro indicadores de validade do construto (exploratório, confirmatório, convergente e preditivo) e dois indicadores de confiabilidade (coerência interna e estabilidade temporal) foram examinados em duas amostras, incluindo 380 e 377 alunos de doutoramento, respectivamente. Obteve-se uma pequena escala unidimensional oito itens (quatro itens que medem o polo de sofrimento e quatro itens que medem o polo de bem-estar) com boas qualidades psicométricas, justificando a sua utilização em estudos posteriores.

Introduction

A growing body of research is examining the psychological health of doctoral researchers, highlighting the potential distress they can endure during their project (Barry et al., 2018; Levecque et al., 2017; Sverdlik & Hall, 2019). According to the meta-analysis by Hazell et al. (2020), existing studies point to a concern, as high levels of anxiety and depression are observed in doctorate researchers. On the other hand, knowledge about well-being during the doctoral journey is scarce, and as a result, current understanding of the situation is incomplete and imprecise (Scott & Takarangi, 2019). This is partly explained by the lack of tools specifically adapted to the doctoral context (Dodd et al., 2021) for measuring both psychological distress and well-being, two inseparable aspects of psychological health (Massé et al., 1998). A tool covering the entire concept of psychological health adapted to the doctoral context is essential for future empirical research examining the predictors and consequences of doctoral researchers' psychological health and for assessing the effectiveness of interventions on this construct. The purpose of this study is to fill this gap by adapting an existing scale of psychological health in the workplace (Gilbert et al., 2011) to develop a short version for the doctoral context and evaluate its psychometric qualities.

The concept and measurement of doctoral researchers' psychological health

This section introduces the concept of psychological health with a definition of its two components: psychological distress and well-being. We go on to explain the particularities resulting from contextualizing psychological health that need to be considered when measuring the construct. The scale for measuring psychological health at work that inspired this study is then presented.

During the first half of last century, research into psychological health was largely influenced by psychopathology. From the 1960s, a new perspective of psychological health was introduced.

No longer defined as the simple absence of mental disorders, the mental state was recognized as a complex continuum (World Health Organization, 2022). This led many researchers to propose that the concept of psychological health comprises both a negative aspect of distress or suffering and a positive aspect of well-being (Gilbert et al., 2011; Keyes, 2002; Massé et al., 1998; Veit et al., 1983). As a result, psychometric assessments of psychological health must address both psychological distress and well-being, two aspects vital to measuring psychological health overall (Massé et al., 1998).

However, existing studies on doctoral researchers' psychological health have tended to examine the negative aspect only (Dodd et al., 2021; Scott & Takarangi, 2019). Hence, the results do not respect this theoretical observation and metric requirement. As a result, current understanding of the situation is only partial, making it difficult to formulate precise conclusions on doctoral researchers' psychological health and to develop solutions for intervention (Wiens et al., 2019).

Psychological distress

The most recent version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) describes psychological distress as a state in which a person experiences various internal symptoms and experiences commonly recognized as troubling (American Psychiatric Association, 2015). In the scholarly literature, psychological distress is more specifically defined as a disturbed psychological state characterized by signs of depression, anxiety, and stress (Lovibond & Lovibond, 1995; Préville et al., 1995; Seelert et al., 1999; Veit et al., 1983).

According to this definition, qualitative studies on doctoral researchers' psychological distress have observed anxiety, depression, and constant concerns, sometimes accompanied by mental and physical fatigue (Cotterall, 2013; Cristia, 2022; Enzor, 2017). More specifically, anxiety experienced during the doctoral project has been characterized by worrying and fear of professional failure. Depression in doctoral researchers is experienced as persistently feeling despair, down, and disinterested in doctoral tasks (Hazell et al., 2020). This conception is also reflected in the tools used to assess psychological distress among doctoral students. Examples include the Depression, Anxiety and Stress Scale - 21 Items (DASS-21) by Lovibond & Lovibond (1995) and the Centre for Epidemiological Studies Depression Scale (CES-D-10) by Andresen et al. (1994) used in the empirical studies by Barry et al. (2018) and Sverdlik and Hall (2019) respectively.

Psychological well-being

The concept of psychological well-being encompasses positive psychological experiences and optimal functioning (Ryan & Deci, 2001), including both the feeling of happiness (hedonic well-being) and optimal functions (eudaimonic well-being). Ed Diener (1984), who pioneered the subjective measurement of psychological well-being (Deci & Ryan, 2008), defines it as overall satisfaction with life, feeling positive, and not feeling negative. Functioning optimally means showing resilience when dealing with problems, which enables flourishing (Rogers, 1963) and realizing one's full potential (Keyes et al., 2002; Ryff, 1995).

In qualitative studies of doctoral student well-being, descriptions of the concept have also reflected these definitions. For example, participants of the study conducted by Vincent et al. (2022) reported psychological well-being when writing their thesis was experienced as positive emotions and easy concentration, echoing the idea of functioning fully. In other studies, doctoral psychological well-being has been described as homeostasis and inner peace between the emotional and intellectual aspects of their doctoral identity (Haynes et al., 2012; Hazell et al., 2020). According to participant testimonies in the study conducted by Haynes et al. (2012), psychological well-being can cover feeling both physically and emotionally healthy as well as feeling in control and balanced. Interestingly, several participants in the same study reported a lack of well-being due to prevalent psychological distress attributed to the pressure of doctoral tasks. This confirms the idea that psychological well-being and distress are inseparable.

Quantitative studies measuring doctoral students' well-being have also used questionnaires based on the positive conception of psychological health. For example, Marais et al. (2018) used the Warwick-Edinburgh Mental Well-being Scale (WEMWBS) (Tennant et al., 2007) that addresses both the hedonic and eudaimonic aspects of psychological well-being, including positive affect (feeling cheerful) and positive functioning (energy, thinking clearly, feeling confident, etc.).

Contextualizing psychological health

Research into psychological health has also revealed that different areas of life and their contexts can give rise to different states of psychological health (Dagenais-Desmarais & Savoie, 2012; Gilbert et al., 2011). For example, a person can feel happy and fulfilled at work while feeling dissatisfied and down about their family life, or vice versa (Talip

et al., 2021). Contexts such as work, study, and family can influence each other, described by the term "spillover theory" coined by Staines (1980). However, psychological health from one sphere of life to another is distinct. Given the characteristics specific to the professional context for doctoral researchers, this seems to be even more the case. The doctorate is a postgraduate course where participants learn to research in coursework, by conducting a research project, and writing a dissertation. It is a professional position with diverse requirements. Doctoral researchers have a hybrid status, as they are neither completely students nor employees (Cristia, 2022). Furthermore, the pressure on them to perform, be productive, and reach perfection is at its peak (Hazell et al., 2020). Many observations have shown that doctoral researchers are particularly sensitive to doctoral pressures and less reactive to personal stress (Enzor, 2017; Hargreaves et al., 2017; Juniper et al., 2012). This suggests that characteristics specific to the context affect doctoral researchers' psychological health, hence the importance of measuring psychological health in this particular context.

However, questionnaires on doctoral researchers' psychological health have often neglected the context, resulting in tools that measure psychological health generally, i.e. where the initial instructions ask participants to refer to life overall (e.g.: Barry et al., 2018; Levecque et al., 2017). Decontextualized psychological health measurement tools do not determine whether the psychological health of doctoral researchers is due to their professional context or influenced by their personal situation. This is a major obstacle to understanding the situation.

The psychological health at work scale, developed by Gilbert et al. (2011), appeared to be a relevant starting point for developing a tool for measuring doctoral researchers' psychological health consistent with the findings of the scholarly literature reviewed.

The scale that inspired this study

Recognizing that it is essential to adopt a contextualized approach to psychological health when measuring this construct, Gilbert et al. (2011) developed a tool to measure a model of psychological health at work in Quebec. Gilbert et al.'s questionnaire is pertinent to this study because it addresses both psychological well-being and distress (Massé et al., 1998). Also, the psychometric qualities of the questionnaire were assessed with French-speaking adults at work in Quebec. The complete instrument includes six subscales, the structure of which was supported using two separate exploratory factor

analyses (EFA). The first EFA was conducted with psychological well-being items: engagement (5 items: $\alpha = 0.84$), social harmony (7 items: $\alpha = 0.82$), and at peace (10 items: $\alpha = 0.86$). The second EFA was conducted with items supposed to measure psychological distress at work and provided three other scales that also proved to be satisfactory psychometric indicators: disengagement (7 items, $\alpha = 0.82$), irritability/aggressivity (7 items, $\alpha = 0.85$) and anxiety/depression (9 items, $\alpha = 0.91$). Finally, the authors proposed that their six subscales of psychological health at work form three pairs that represent (a) the relationship with work: engagement vs disengagement; (b) the relationship with others: social harmony vs irritability/aggressivity; and (c) the relationship with self: at peace vs anxiety/depression.

For the present study, the self-relation subscales were particularly relevant, as they are based on indicators of happiness, emotional balance, good functioning and distress at work, thus reflecting the concept of psychological health to be adapted to the doctoral context. The other subscales are less pertinent for our scale as they contain variables considered to be predictive of psychological health rather than inherent to the concept. For example, according to Diener et al., (1998), the engagement and disengagement subscales represent variables that predict psychological well-being, which was confirmed by Vekkaila et al. (2014) in their study of doctoral researchers. We therefore decided to use these subscales to examine the predictive capacity of our scale. The items in the subscales of the relationship with others seem to measure extroversion, a personality trait (Costa & McCrae, 2008) positively linked to psychological health at the doctoral level (Dodd et al., 2021), but not an indicator of the construct. Therefore, we did not use the items in the social harmony and irritability/aggressivity subscales of Gilbert et al. (2011) when designing our scale.

This study

The purpose of this study was to develop a short, contextualized psychological health measurement instrument for the doctoral context: the Doctoral Psychological Health Scale (DPHS). After approval by the authors' home institution research ethics board (ethical certificate number 2022-3687), data was collected from doctoral researchers to examine the structure and psychometric qualities of the instrument.

Developing the questionnaire

We followed the steps recommended in DeVellis and Thorpe's scale development procedure (2021).

Clarifying the construct to be measured, generating the item pool, and selecting the measurement format

We began by clearly determining the objective of the scale: measure indicators of psychological health in doctoral researchers, and not predictors or consequences of the construct. The 19 self-relation items in the scale by Gilbert et al. (2011) were adapted to the doctoral context by changing the term "work" to "doctorate" or "doctoral project". Gilbert et al.'s (2011) six items related to work, three for engagement and three for disengagement, were adapted to the doctoral context (Vekkaila et al., 2014) to examine the predictive capacity of the DPSH, not for inclusion in the scale. We used the same five-point unidimensional Likert scale as Gilbert et al. (2011) to measure the frequency of signs of psychological health in doctoral researchers from 1 (never) to 5 (always). Our choice was driven by recommendations from previous studies indicating that unidimensional response scales are generally more reliable than bidimensional scales (Alwin et al., 2018). Furthermore, a five-point scale is the ideal balance between too many (more than seven) and too few (less than four) propositions for respondents to select from about their experience (Alwin et al., 2018).

Item pool review by an expert committee

Three professors with expertise in measurement, psychological health, and the doctoral context were invited to review the item pool. Each expert reviewed and commented on the items one by one to improve clarity, assess relevance, and identify the variable of the doctoral context the item reflected. As a result, six of Gilbert et al.'s (2011) 19 self-relation items were redundant and removed because they doubled up with other items or because they appeared to measure self-esteem rather than psychological health in doctoral researchers (Dodd et al., 2021). Five of the remaining items were identified as reflecting psychological well-being in doctoral researchers and the other five as reflecting psychological distress in doctoral researchers. The last three items were recognized as external to the doctorate, more accurately measuring work-life balance (Giudicelli et al., 2022). As previous studies have identified this construct as a predictor of doctoral psychological health (Haider & Dasti, 2022; Hazell et al., 2020), the committee agreed it was relevant to adapt these items to the doctoral context to examine the predictive capacity of the DPHS, but not for inclusion in the tool. The same applied to Gilbert et al.'s (2011) engagement and disengagement items. Table 1 shows the items, the initial factors in Gilbert et al. (2011), the expert committee's selection of items to be kept or deleted according to literature on the doctoral context, and the item codes used in this article.

Table 1
Items adapted and kept by the committee of experts based on the available literature

Items	**Factors: Gilbert et al. (2011)**	**Items adapted and kept by the committee of experts based on the available literature**	**Codes**
I feel emotionally balanced.	Serenity	Keep: measures psychological well-being in the doctoral context (Haynes et al., 2012).	WB1
I feel good and at peace with my identity as a doctoral researcher.	Serenity	Keep: measures psychological well-being in the doctoral context (Haynes et al., 2012).	WB2
I feel healthy and in top shape.	Serenity	Keep: measures psychological well-being in the doctoral context (Haynes et al., 2012).	WB3
I know how to deal positively with the challenges in the doctorate.	Serenity	Keep: measures psychological well-being in the doctoral context (Haynes et al., 2012).	WB4
My moral is good.	Serenity	Keep: measures psychological well-being in the doctoral context (Haynes et al., 2012).	WB5
I have difficulty facing challenges in the doctorate.	Anxiety/ depression	Keep: measures psychological distress in the doctoral context (Haynes et al., 2012).	DIST1
I feel sad.	Anxiety/ depression	Keep: measures psychological distress in the doctoral context (Haynes et al., 2012).	DIST2
I feel preoccupied and anxious.	Anxiety/ depression	Keep: measures psychological distress in the doctoral context (Haynes et al., 2012).	DIST3
I feel depressed and down.	Anxiety/ depression	Keep: measures psychological distress in the doctoral context (Haynes et al., 2012).	DIST4
I have difficulty concentrating.	Anxiety/ depression	Keep to measure psychological distress in the doctoral context (Vincent et al., 2022).	DIST5
I'm pretty calm and settled.	Serenity	Delete: item considered redundant due to item DIST3 which measures the opposite state.	
It's easy for me to find solutions to my problems in the doctorate.	Serenity	Delete: item considered redundant due to item DIST1 which measures the opposite state.	
I have the impression no one loves me.	Anxiety/ depression	Delete: refers to self-esteem (Dodd et al., 2021).	
I lack self-confidence.	Anxiety/ depression	Delete: refers to self-esteem (Dodd et al., 2021).	

Items	Factors: Gilbert et al. (2011)	Items adapted and kept by the committee of experts based on the available literature	Codes
I feel ill at ease with myself.	Anxiety/ depression	Delete: item considered redundant due to item WB2 which measures the opposite state.	
I feel stressed and under pressure.	Anxiety/ depression	Delete: item considered redundant due to item DIST3.	
I'm motivated to do activities and have hobbies outside my doctorate.	Serenity	Keep: measures life balance (Giudicelli et al., 2022) and examines predictive capacity (Haider et Dasti, 2022; Hazell et al., 2020).	BAL1
My life is well balanced between my professional, family and personal activities.	Serenity	Keep: measures life balance (Giudicelli et al., 2022) and examines predictive capacity (Haider & Dasti, 2022; Hazell et al., 2020).	BAL2
I work at a normal pace, not doing anything excessively.	Serenity	Keep: measures life balance (Giudicelli et al., 2022) and examines predictive capacity (Haider & Dasti, 2022; Hazell et al., 2020).	BAL3
I don't feel like doing anything.	Disengagement	Keep: measures disengagement from the doctoral project (Vekkaila et al., 2014) and examines predictive capacity.	DISE1
I feel like throwing everything to the wind, quitting.	Disengagement	Keep: measures disengagement from the doctoral project (Vekkaila et al., 2014) and examines predictive capacity.	DISE2
I feel disinterested in my doctorate.	Disengagement	Keep: measures disengagement from the doctoral project (Vekkaila et al., 2014) and examines predictive capacity.	DISE3
I have goals and ambitions.	Engagement	Keep: measures engagement in the doctoral project (Vekkaila et al., 2014) and examines predictive capacity.	ENG1
I am excited about my doctoral journey and I want to make the most of it.	Engagement	Keep: measures engagement in the doctoral project (Vekkaila et al., 2014) and examines predictive capacity.	ENG2
I'm really enjoying my doctorate.	Engagement	Keep: measures engagement in the doctoral project (Vekkaila et al., 2014) and examines predictive capacity.	ENG3

Source: This table was created by the authors.

Finally, the article's lead author conducted a one-hour online focus group to assess how potential respondents would interpret and understand the items. The group included five doctoral researchers from various disciplines and universities in Quebec. In screen-sharing mode via Zoom, they discussed each item and how it reflected the construct to confirm its relevance. All the doctoral researchers approved the content so no additional changes were made at this stage.

Administering the questionnaire

The questionnaire was transposed on the LimeSurvey online platform with the consent form, socio-demographic questions (gender, age), academic questions (doctoral advancement, discipline, home university), and the 19 selected items referring to the doctoral project: well-being, distress, life balance, engagement and disengagement. Completing the questionnaire took less than 10 minutes. To avoid missing data, it was impossible for participants to send the completed questionnaire without answering all the items.

Recruitment and instructions

The lead author distributed a recruitment poster with the questionnaire link via email and social networks to Quebec and Ontario university doctoral programs and their graduate student associations. The recruitment campaign was organized over six months, from June to November 2021. The aim was to collect 10 times more participants than the number of items and to avoid data analysis problems (Hair et al., 2019).

The following instruction was given to guide participants to respond about their feelings in the doctoral context: How often did you experience these signs of psychological health in relation to your doctoral studies in the last three weeks, including the present?

Sampling

A total of 757 doctoral researchers completed the online questionnaire. The data was then imported into the Statistical Package for the Social Sciences (SPSS) software, version 28 (IBM®, 2021-2022). The database was randomly split in two to create two independent samples to assess the psychometric qualities of the DPHS. Table 2 shows the characteristics of the two samples.

Table 2
Socio-demographic characteristics

	Sample 1	**Sample 2**
Total number of participants	380	377
Gender, *n* (%)		
Female	286 (75,3)	280 (74,3)
Male	92 (24,2)	91 (24,1)
Other	2 (0,6)	6 (1,6)
Doctoral advancement, *n* (%)		
Coursework	199 (52,4)	205 (54,4)
Writing	181 (47,6)	172 (45,6)
Discipline, *n* (%)		
Business, humanities, health, arts, social science and education (BHASE)	237 (62,4)	239 (63,4)
Sciences, technology, engineering and maths (STEM)	143 (37,6)	138 (36,6)

Source: This table was created by the authors.

Both samples featured a larger proportion of BHASE researchers who identified as women. The mean age of participants in both samples was similar at 31.48 years (SD = 7.35) for Sample 1 and 31.39 years (SD = 6.83) for Sample 2.

Results

Item performance

The first step was to conduct descriptive analyses to assess item performance by examining means, standard deviations, skewness, kurtosis, and inter-item correlation. We looked for means near the center of the Likert scale which would suggest good discrimination (DeVellis & Thorpe, 2021). The targeted values of skewness and kurtosis for each item were between -1 and 1 (Hair et al., 2019). We focused on very low (< 0.10) and very high (> 0.90) correlation coefficients, problematic in an inter-item correlation matrix. To establish a theoretical link between the items (Hair et al., 2019), we looked for low (< 0.35), moderate (0.36 to 0.67) and high (0.68 to 0.89) correlations. Table 3 shows item performance.

Table 3
Item means, standard deviations, skewness and kurtosis

	Sample 1				Sample 2			
Items	***M***	***SD***	**Skew-ness**	**Kur-tosis**	***M***	***SD***	**Skew-ness**	**Kur-tosis**
WB1	3.25	0.93	0.06	-0.58	3.20	0.91	0.27	-0.51
WB2	3.27	1.03	-0.03	-0.67	3.31	0.99	-0.17	-0.40
WB3	3.15	1.03	-0.06	-0.48	3.12	0.99	0.01	-0.62
WB4	3.42	0.85	-0.28	0.24	3.43	0.88	-0.07	-0.32
WB5	3.51	0.86	0.01	-0.64	3.53	0.86	-0.08	-0.29
DIST1	2.38	0.89	0.68	0.43	2.31	0.86	0.46	-0.12
DIST2	2.42	0.91	0.71	0.11	2.47	0.95	0.58	-0.19
DIST3	3.46	1.07	-0.21	-0.78	3.40	1.13	-0.26	-0.75
DIST4	2.60	1.03	0.56	-0.36	2.60	1.03	0.39	-0.46
DIST5	3.03	1.12	0.30	-0.84	3.00	1.14	0.02	-0.89
BAL1	3.84	1.01	-0.48	-0.59	3.92	0.97	-0.58	-0.41
BAL2	2.96	1.06	0.09	-0.76	2.91	1.07	0.10	-0.64
BAL3	3.02	1.05	0.04	-0.67	3.03	1.09	0.14	-0.67
DISE1	2.36	1.08	0.55	-0.31	2.28	1.08	0.57	-0.52
DISE2	2.24	1.06	0.79	0.12	2.21	1.06	0.70	-0.24
DISE3	2.16	1.09	0.79	-0.13	2.10	1.04	0.91	0.43
ENG1	4.19	0.84	-0.84	0.08	4.14	0.87	-0.78	0.11
ENG2	3.51	1.04	-0.29	-0.46	3.51	1.00	-0.17	-0.66
ENG3	3.33	1.04	-0.12	-0.54	3.29	0.98	-0.09	-0.40

Sourc: This table was created by the authors.

Table 3 shows means between 2.10 and 4.19 and item skewness and kurtosis within the limits suggested by Hair et al. (2019).

The inter-item correlation matrix of Sample 1 presented in Annex A led to two observations. Correlations between the well-being and psychological distress items during doctoral projects correlated moderately or strongly (0.40 to 0.77), going from a positive correlation between the items of the same pole (well-being or distress) to a negative correlation between the items of the two opposite poles (well-being vs distress). These results suggest the same construct was measured, rather than two separate constructs. The same trend was observed between the engagement and disengagement items (0.36 and 0.80). On the other hand, life balance

items correlated less strongly with other items (0.20 to 0.48), suggesting that psychological health in the doctoral context and life balance are distinct constructs. Note that the inter-item correlation matrix of Sample 2 produced the same observations. To be concise, it is not presented here.

Exploring the DPHS structure using exploratory factor analyses

Before conducting the EFAs, the conditions for applying this strategy were verified. Thus, two indicators were examined: Bartlett's sphericity test, which must be statistically significant, and the Kaiser-Meyer-Olkin index (KMO), which must exceed 0.60 (Achim, 2020). EFA by principal axis factoring was then conducted to examine the number of factors that emerged (Achim, 2020) when all 19 items were considered, from the DPHS, life balance, and doctoral engagement and disengagement. According to recommendations by Hair et al. (2019), the Oblimin rotation method was selected due to correlations between the factors. Only items with a saturation coefficient above the threshold of 0.40 in each scale were kept. Hair et al. (2019) recommended deleting items for a consistent structure which can be interpreted conceptually.

Satisfactory results from the Bartlett's sphericity test ($\chi^2(171) = 4{,}311.37$; $p < 0.001$) and KMO (0.941) provided the conditions for conducting the EFA by principal axis factoring on Sample 1. The projections from the factorial design matrix suggested three factors shown in Table 4.

The results in Table 4 show that the psychological well-being and distress items saturated together in the same factor (psychological health), which confirmed the DPHS is unidimensional. When a set of items is grouped in the same factor, a latent variable explains all the observed correlations (Falissard, 2006). This was also the case for Gilbert et al.'s (2011) engagement and disengagement items. Table 4 also shows that three items were problematic: WB4, DISE1, and ENG1. The first two saturated in both the psychological health factor and the engagement/disengagement factor, while the third simply did not reach the expected saturation threshold. As a result, according to recommendations by Hair et al. (2019), these three items were deleted before proceeding with further analyses. We also tried to force the five-factor analysis, but it did not reproduce the expected structure. Given the DPHS and the engagement/disengagement scale are unidimensional, items which were negatively saturated in the first EFA, distress and disengagement, were reversed for further analysis.

Table 4
Initial results of exploratory factor analysis by principal axis factoring

Items	Psychological health	Engagement/ disengagement	Balance
DIST4	-0.87		
DIST2	-0.83		
WB2	0.76		
WB5	0.76		
DIST3	-0.67		
DIST1	-0.67		
WB1	0.65		
WB3	0.65		
DIST5	-0.52		
WB4	0.43	0.40	
DISE1	-0.40	-0.41	
ENG2		0.91	
ENG3		0.86	
DISE3		-0.80	
DISE2		-0.58	
ENG1		0.36	
BAL2			0.71
BAL3			0.68
BAL1			0.41

Source: This table was created by the authors.

A final EFA was conducted after the changes. To provide a reliability index for the scale, the internal consistency of the scales was assessed using Cronbach's alpha (α) and McDonald's Omega Index (ω) (Hayes & Coutts, 2020), recommending a threshold of 0.70 to indicate good reliability (Hair et al., 2019). Table 5 presents the saturation coefficients of the final EFA and internal consistency indices (α and ω).

Table 5
Final results of the EFA by principal axis factoring

	Psychological health (α = 0.92; ω = 0.92)	**Engagement/ disengagement (α = 0.89; ω = 0.89)**	**Balance (α = 0.68; ω = 0.68)**
DIST4r	0.89		
DIST2r	0.85		
WB5	0.75		
WB2	0.75		
DIST3r	0.67		
DIST1r	0.67		
WB1	0.63		
WB3	0.62		
DIST5r	0.51		
ENG2		0.88	
ENG3		0.85	
DISE3r		0.79	
DISE2r		0.57	
BAL2			0.73
BAL3			0.63
BAL1			0.40

Source: This table was created by the authors.
Note: The "r" added to some codes indicates when the Likert scale was reversed.

Table 5 shows the saturation coefficients were all satisfactory (> 0.40) and there was no longer any cosaturation, revealing a good fit between items and their factor (Hair et al., 2019). Furthermore, the three final factors respectively accounted for 44.52%, 9.15%, and 4.30% of the shared variance of the data with a total of 57.96%. These results confirm assumptions made by the expert committee presented in Table 1 about distinctions between psychological health and both life balance and engagement/disengagement. Finally, Table 5 also shows that the DPHS had high internal consistency (α and ω = 0.92), largely exceeding the suggested threshold of 0.70 to indicate good fidelity (Hair et al., 2019). The engagement/disengagement scale also showed good internal consistency (α and ω = 0.89), while the life balance scale showed indices slightly below the set threshold (α and ω = 0.68). Review of the results also revealed that deleting an item did not increase internal consistency of the scales.

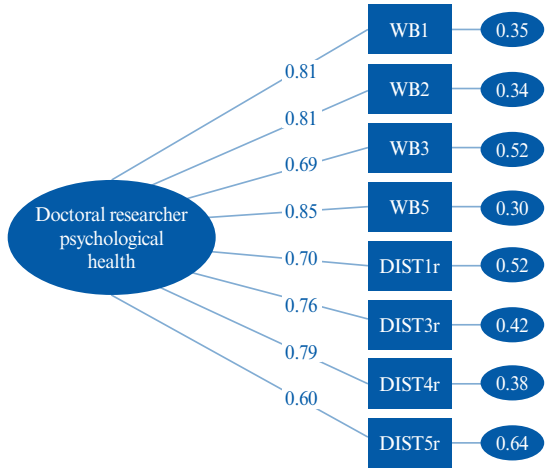
Confirming the DPHS structure using confirmatory factor analyses

Using RStudio software (lavaan package, MLE maximum likelihood estimation by default, NLMINB optimization method, RStudio team), a confirmatory factor analysis (CFA) was conducted on Sample 2 to examine different models and confirm the final structure of the DPHS. We assessed the model fit using the comparative fit index (CFI), the Tucker-Lewis index (TLI), standardized root mean square residual (SRMR), and root mean square error of approximation (RMSEA). According to Hair et al. (2019, p. 642), for samples exceeding 250 participants and models of less than 12 variables, good fit between the model and data is indicated by a CFI and TLI greater than 0.96, an SRMR greater than 0.08, and an RMSEA less than 0.07. Note that the chi-square indicator (χ^2), requiring a nonsignificant *p* value, is sensitive to sample size and tends to be significant in a large sample like ours. As a result, we reported this indicator but it was not used to assess the psychometric qualities of the model.

A first AFC was conducted by reproducing the unidimensional model of the DPHS from the EFA. The results (CFI = 0.92; TLI = 0.90; SRMR = 0.04; RMSEA = 0.12 [0.11-0.14]; $\chi^2(35) = 224.19$; $p < 0.000$) suggest the CFI, TLI, and RMSEA fit indices were unsatisfactory as the CFI and TLI were below the suggested minimum threshold of 0.96 and the RMSEA exceeded the suggested maximum threshold of 0.07. The data also indicated that the model included error covariance of 0.52 between the error terms of items DIST2 and DIST4, indicating the structure lacked validity according to Hair et al. (2019). This error covariance suggested another unmeasured factor at this stage - possibly depression, one of the distress indicators - that explains the relationship. In such situations, Hair et al. (2019) suggested not adding covariance between error terms as this would artificially improve the fit. We tested the model without item DIST2 (sadness) which was possibly too similar to item DIST4 (feeling down) to measure depression as an indicator of psychological distress. The results (CFI = 0.97; TLI = 0.96; SRMR = 0.03; RMSEA = 0.07 [0.06 - 0.10]; $\chi^2(20) = 65.20$; $p < 0.000$) suggested that this new model (see Figure 1) had satisfactory fit indices, unlike the first model.

Figure 1 shows the saturation coefficients all largely exceeded the suggested threshold of 0.60 and suitable error variances (Hair et al., 2019). As a result, the unidimensional eight-item model of the DPHS ($\omega = 0.91$) was retained for the rest of the analyses. The final scale items are shown in Annex B.

Figure 1
Unidimensional model of the DPHS including saturation coefficients and standardized error variances



The convergent capacity of the DPHS

A *t*-test for independent samples was conducted to check the scale's capacity to reproduce links discussed in the literature about the differences between women and men's psychological health scores. The anticipated results were based on many studies which have demonstrated that women report more psychological health problems than men at the doctoral level, including the meta-analysis by Hazell et al. (2020) and many other studies around the world (Boisselier et al., 2022; Hargreaves et al., 2017; Juniper et al., 2012; Levecque et al., 2017). The *t*-test was conducted to show whether the difference observed between the means of two groups was statistically significant. See Table 6 for the results of the *t*-test comparing the average psychological health score of women and men.

The results showed that the DPHS effectively reproduced the links documented in the literature regarding differences between women and men's psychological health scores: women's scores were statistically lower and the difference provided a large effect size.

Table 6
Results of the t-test comparing the average psychological health score of women and men.

	Women (n = 280)		Men (n = 91)					
	M	***SD***	***M***	***SD***	***t***	***ddl***	***p***	**Cohen's *d***
DPHS	3.19/5	0.76	3.43/5	0.77	-2.60	37	0.01	0.76

Source: This table was created by the authors.

The structural stability of the DPHS

Invariance analysis was conducted to ensure the difference in scores was not attributable to different understandings of the DPHS items by gender (female vs male). For that purpose, we tested the configural, metric, scalar, and strict invariance models by evaluating the comparison of consecutive levels of invariance between metric, scalar, and strict invariance models, as suggested by Putnick and Bornstein (2016). To accept the invariance hypothesis, the ΔCFI must not decrease by more than 0.01, the ΔRMSEA must not increase by more than 0.02, and the ΔSRMR must not increase by more than 0.03 for metric invariance and 0.015 for scalar invariance. These results are shown in Table 7.

Table 7
Invariance test results of the DPHS by gender

Models	**χ2**	***ddl***	**CFI**	**RMSEA (95% IC)**	**SRMR**	**ΔCFI**	**ΔRMSEA**	**ΔSRMR**	**Decision**
Configural	78.87	40	0.98	0.07	0.03	N/A	N/A	N/A	N/A
Metric	89.68	47	0.97	0.07	0.05	-0.002	-0.002	0.018	Accepted
Scalar	100.77	54	0.97	0.07	0.05	-0.003	-0.002	0.002	Accepted
Strict	109.49	62	0.97	0.06	0.05	0.000	-0.004	0.001	Accepted

Source: This table was created by the authors.

As reported in Table 7, the invariance assumptions were accepted for all models, showing the unidimensional structure of the eight-item DPHS did not significantly differ for gender.

Another invariance analysis was performed with "doctoral advancement" as the binary variable to ensure DPHS structure did not change depending on the participant's stage in their project: coursework vs writing. These results are shown in Table 8.

Table 8
DPHS invariance test results by doctoral advancement

Models	χ2	*ddl*	CFI	RMSEA (95% IC)	SRMR	ΔCFI	ΔRMSEA	ΔSRMR	Decision
Configural	84.05	40	0.97	0.08	0.03	N/A	N/A	N/A	N/A
Metric	85.32	47	0.98	0.06	0.03	0.004	-0.010	0.003	Accepted
Scalar	95.38	54	0.98	0.08	0.04	-0.002	-0.002	0.003	Accepted
Strict	116.63	62	0.97	0.07	0.04	-0.008	0.004	0.007	Accepted

Source: This table was created by the authors.

As reported in Table 8, the invariance assumptions were accepted for all models, showing the unidimensional structure of the eight-item DPHS did not significantly differ for doctoral advancement.

The predictive capacity of the DPHS

Finally, to examine the predictive capacity of the DPHS (DeVellis & Thorpe, 2021), a correlation matrix was generated between the scales to check whether the DPHS was associated with life balance and engagement/disengagement in the doctorate, as proposed by Vekkaila et al. (2014). For a sufficiently strong link and satisfactory predictive capacity, the Pearson coefficient must be at least 0.20 (Hair et al., 2019).

Table 9 shows the means and standard deviations and the correlation matrix between the DPHS, the life balance scale (BAL) and the engagement/disengagement scale (ENG).

Table 9
Means, standard deviation and bivariate correlation matrix between scales

	M	*SD*	*r*		
			DPHS	BAL	ENG
DPHS	3.23/5	0.77	1		
BAL	3.29/5	0.81	0.52	1	
ENG	3.63/5	0.87	0.63	0.32	1

Source: This table was created by the authors.
Note: All the correlations are significant: $p < 0.001$.

The DPHS seemed to correlate positively and moderately with life balance and engagement in the doctorate. This result suggested that levels of psychological health are linked with life balance and engagement in the doctorate. The correlation between life balance and engagement was also positive, but rather weak. Overall, the results provided an indicator for the predictive capacity of the DPHS.

Discussion

The purpose of this study was to develop a new instrument to measure both positive and negative aspects of psychological health in the doctorate context, according to the approach proposed by DeVellis & Thorpe (2021). The data collected was analyzed to examine the DPHS structure and item performance using exploratory analysis on Sample 1 and confirmatory analysis on Sample 2.

The DPHS: a single-factor scale

The EFA results of the first sample suggested a single factor for psychological well-being and distress items (DPSH), a second factor for engagement and disengagement items in the doctorate context, and a third factor representing, according to our hypothesis, the balance between personal life and the doctorate. As planned, the last two factors were then used to examine the predictive capacity of the DPHS. Several items with insufficient saturation or cosaturation were deleted, including a well-being item in the DPHS. At this stage, the DPSH included nine items with good internal consistency. These results suggested that psychological health for doctoral researchers lies on a continuum from psychological well-being to psychological distress, indicating the coexistence of the two aspects. As a result, a respondent's indicators of distress will be inversely proportionate to well-being indicators. For example, a doctoral researcher with a high level of psychological distress will also report a low level of psychological well-being.

The CFA on the second sample testing the unidimensional structure of the nine-item DPHS did not show good fit indexes, due to high error covariance between two items. This result suggested there was another factor explaining the covariance relationship. The two items linked by this covariance were about sadness and depression, both characteristic of the depressive affect (Lovibond & Lovibond, 1995), suggesting the underlying factor is depression. It was therefore necessary to remove another item

(Hair et al., 2019), in this case about sadness as this emotion is referred to less frequently than depression in the literature on doctoral students (Hazell et al., 2020). The results of the second CFA of the eight-item DPHS showed a good fit. Moreover, this structure proved invariant to gender and advancement in the doctorate journey.

At first glance, these results seem contradictory with the findings of Massé et al. (1998) and Gilbert et al. (2011) who suggested using separate scales for psychological distress and well-being. Yet our results are consistent with other findings from their studies. Indeed, Massé et al. (1998) conclude by suggesting that psychological distress (anxiety/depression) and psychological well-being (happiness) are covariants and correlated (r = -0.65), and therefore not entirely independent. This study shows that positive and negative psychological health items inserted in the same scale specific to doctoral researchers are not two different components but rather a continuum spanning from a positive to a negative pole of psychological health. Thus, the DPHS measures indicators of good psychological health (feeling in top shape, at peace, balanced, and happy as a doctoral researcher) and poor psychological health (anxiety, feeling down, difficulty concentrating and coping with problems for the doctorate). It is also interesting to note that this view of psychological health along a continuum is consistent with the proposition by Keyes (2002) that a person who is struggling (languishing) cannot be happy (flourishing) at the same time.

The DPHS: a contextualized scale for doctoral researchers

Two main factors suggest that the DPHS is a more precise measure of doctoral researchers' psychological health than a scale designed to measure psychological health generally. On the one hand, the tool measures psychological health in doctoral researchers, including psychological well-being indicators. This score can be calculated by adding the means of the responses, after inverting the items measuring negative psychological health. The score ranges from the sum of 8 or a mean of 1, indicating the worst psychological health in doctoral researchers, to 40 or 5 for the best psychological health in doctoral researchers. The mean score of 3.23 for the participants in our study indicates that the sample participants had good psychological health for about half the time. Yet, using a scale measuring only psychological distress would have suggested - incorrectly - signs of bad psychological health exclusively, as reported by existing studies (Hazell et al., 2020; Levecque et al., 2017). Furthermore, other

researchers, such as Wiens et al. (2019), have expressed doubts about the validity of conclusions based exclusively on psychological distress measures which incorrectly suggested "a psychological health crisis among doctoral researchers". By simultaneously considering psychological well-being and distress, the DPHS enables researchers to paint a more accurate picture of the psychological health of doctoral researchers.

On the other hand, unlike scales measuring general psychological health, the DPHS measures indicators of psychological health in researchers in the doctoral context and not in any other life context, nor in all spheres of life combined. Indeed, the DPSH instructions ask participants to reflect and indicate frequency of signs of psychological health specifically in the context of their doctoral studies. As a result, the developed instrument enables the assessment of psychological health in the doctorate, a sphere in which doctoral researchers feel heightened sensitivity and reactivity to their concerns relative to the context (Enzor, 2017). The specific nature of this instrument is even more important given the fact that psychological health is recognized to vary with context, for example at work vs in private life (Talip et al., 2021).

The DPHS: predictor of other indicators of doctorate success

The DPHS showed satisfactory predictive capacity for variables specific to the doctorate context such as engagement/disengagement and life balance, confirming the conclusions of Vekkaila et al.(2014) and Haider and Dasti (2022) respectively. When doctoral researchers have negative psychological experiences, it is associated with disengagement from their project and future academic career, and an imbalance with other areas of their life, such as a physical or emotional rupture with friends and family (Hazell et al., 2020). These results suggest that interventions to promote psychological health during doctoral studies are not only likely to improve their psychological health but also promote a healthier work-life balance. It therefore seems essential to organize course content and resources to raise awareness among doctoral researchers, from the very beginning of their project, of the potential consequences of poor psychological health during their doctoral journey.

Limitations and directions for future research

Despite the rigor surrounding this study, there are certain limitations. First, a convenience sample was used for this project, which is likely to limit the potential for generalizing the results. For example, it is possible that

female doctoral researchers are more interested in this study than their male counterparts. We recommend future studies request help from universities for recruitment to systematize the data collection and ensure a diverse sample.

Another limitation of this study is the nonexistence of other measurements that would provide additional proof of the instrument's validity and fidelity. For example, repeated-measure design could be used to check the test-retest validity of the instrument: the association between the scores of the tool at two different timepoints, while taking into account that the DPHS is designed as a measure of state rather than trait. However, if future research is undertaken with this purpose, note that a very high test-retest correlation is not preferable, as it may suggest an incapacity to detect changes in the participants' emotional states over time. The test-retest correlation value should be interpreted in view of legitimate variations of the participants' emotional states during the retest period. Another measure of psychological health for the work context could examine the concurrent validity: the association between the new instrument and another validated instrument measuring a similar construct. Finally, for the purposes of this study, we considered that the intervals between choices in the Likert scale were equal, typical of psychology and education research practices. However, other researchers support that the Likert-type scale is for producing data per interval only, which limits certain analyses. This is an ongoing debate according to DeVellis and Thorpe (2021).

Despite these limitations, this innovative study successfully developed a short instrument for measuring the psychological health of doctoral researchers which shows strong psychometric qualities. This new tool has the potential to improve understanding about the state of doctoral researchers' psychological health in Quebec and other French-speaking communities. The scale could also be used in future studies exploring why doctoral researchers flourish emotionally and professionally (Giudicelli et al., 2022), and outcomes related to the psychological health of doctoral researchers, such as perseverance or dropping out (González-Betancor & Dorta-González, 2020). Improving our understanding of the psychological context for doctoral researchers is vital for taking effective action to both improve their psychological well-being and ensure they perceive their doctoral journey as a positive - even optimal - experience (Giudicelli et al., 2022). Future research should therefore focus on the development and assessment of strategies for action to improve doctoral researchers'

well-being. Such strategies, based on enhanced understanding of doctoral researchers' psychological health, could include psychological support tailored to the doctoral context and university policies promoting balance and well-being.

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Annex A. Inter-item correlation matrix

Items	WB1	WB2	WB3	WB4	WB5	DIST1	DIST2	DIST3	DIST4	DIST5	BAL1	BAL2	BAL3	DISE1	DISE2	DISE3	ENG1	ENG2
WB1	1																	
WB2	0.61	1																
WB3	0.53	0.62	1															
WB4	0.57	0.53	0.40	1														
WB5	0.67	0.66	0.57	0.60	1													
DIST1	-0.50	-0.52	-0.41	-0.57	-0.52	1												
DIST2	-0.52	-0.57	-0.48	-0.50	-0.62	0.55	1											
DIST3	-0.57	-0.59	-0.52	-0.55	-0.59	0.55	0.57	1										
DIST4	-0.55	-0.63	-0.55	-0.53	-0.64	0.60	0.77	0.64	1									
DIST5	-0.48	-0.46	-0.47	-0.47	-0.49	0.49	0.46	0.52	0.56	1								
BAL1	0.29	0.28	0.36	0.20	0.27	-0.21	-0.25	-0.27	-0.29	-0.23	1							
BAL2	0.46	0.42	0.48	0.43	0.42	-0.37	-0.37	-0.48	-0.44	-0.41	0.39	1						
BAL3	0.24	0.31	0.33	0.27	0.29	-0.19	-0.23	-0.39	-0.24	-0.22	0.30	0.52	1					
DISE1	-0.43	-0.43	-0.43	-0.50	-0.50	0.45	0.55	0.51	0.62	0.49	-0.28	-0.40	-0.18	1				
DISE2	-0.40	-0.42	-0.30	-0.49	-0.47	0.42	0.52	0.42	0.55	0.44	-0.19	-0.37	-0.17	0.58	1			
DISE3	-0.35	-0.30	-0.18	-0.47	-0.41	0.39	0.43	0.33	0.46	0.35	-0.07	-0.25	-0.07	0.54	0.67	1		
ENG1	0.40	0.36	0.26	0.39	0.39	-0.36	-0.35	-0.25	-0.33	-0.36	0.20	0.21	-0.02	-0.36	-0.38	-0.43	1	
ENG2	0.40	0.37	0.26	0.56	0.42	-0.39	-0.40	-0.35	-0.43	-0.38	0.17	0.39	0.12	-0.53	-0.59	-0.66	0.45	1
ENG3	0.43	0.42	0.29	0.57	0.46	-0.37	-0.41	-0.36	-0.44	-0.43	0.17	0.34	0.14	-0.54	-0.59	-0.69	0.44	0.80

Note: All the correlations are significant: $p < 0.01$.

Annex B – Doctoral Psychological Health Scale (DPHS)

Instructions: Indicate how frequently you have experienced these signs of psychological health in your doctoral studies over the last three weeks, including the present.

Likert scale

1. Never
2. Rarely
3. Half the time
4. Frequently
5. All the time

Items

1. I feel depressed and down.
2. I feel preoccupied and anxious.
3. I have difficulty concentrating.
4. I have difficulty facing challenges of the doctorate.
5. My moral is good.
6. I feel good, at peace, in my identity as a doctoral researcher.
7. I feel balanced emotionally.
8. I feel healthy. I'm in top shape.