Design and validation of the digital well-being scale

Roseline Gomes
Jyoti Nivas College

Jain Mathew
CHRIST University

Sridevi Nair
CHRIST University

Ankita Mulasi
Presidency University

Preksha Yadav
CMR Institute of Technology

Abstract

As the reliance on digital products and services continues to increase, there arises the need to measure and understand how the use of digital devices affects our well-being. In order to do so, the researchers attempted to create and validate an instrument. The items for the instrument were identified through an extensive review of literature, followed by a brainstorming session. The statements were then validated by a panel of experts, post which the instrument was administered, and the data was collected and analyzed for reliability and validity. The final instrument returned a Cronbach's alpha score of 0.921, indicating high reliability. The validity of the instrument was also established through a confirmatory factor analysis.

Poiché la dipendenza da prodotti e servizi digitali continua ad aumentare, sorge la necessità di misurare e comprendere in che modo l'uso dei dispositivi digitali influisce sul nostro benessere. Per fare ciò, i ricercatori hanno tentato di creare e convalidare uno strumento. Gli items per lo strumento sono stati identificati attraverso un'ampia revisione della letteratura, seguita da una sessione di brainstorming. Le dichiarazioni sono state convalidate da un gruppo di esperti in seguito alla somministrazione dello strumento, e i dati sono stati raccolti e analizzati per valutare l'affidabilità e la validità. Lo strumento finale ha restituito un punteggio alfa di Cronbach di 0,921, che indica un'elevata affidabilità. La validità dello strumento è stata stabilita anche attraverso un'analisi fattoriale confermativa.

Keywords: well-being; digital; scale development; online

Parole chiave: benessere; digitale; sviluppo di una scala; online

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1. Introduction

While several attempts have been made to define well-being, a widely accepted definition of the term does not exist. Ong et al. (2021), analyzed existing definitions of well-being and found that they were mainly descriptions of the dimensions of well-being rather than definitions. Additionally, they termed the concept as subjective well-being or SWB, as it is usually a self-reported measure that reflects an individual's self-evaluation of their level of well-being.

The review of literature on well-being highlighted a dearth of studies on online well-being over the last five years. One study by Kearns and Whitley (2019), evaluated the impact of the online environment on well-being but the researchers were forced to use a traditional well-being measure by Tennant et al., (2007) for the study, due to the absence of a well-being scale designed for the online environment.

According to Briciu and Briciu (2021), the online environment may be defined as the virtual space in which a computed defined system can function being connected to other(s) connected systems through a communication electronic channel and sharing content. Thus, it primarily refers to the virtual world that we use to connect with one another. The design and creation of a validated tool to measure online wellbeing would encourage further study into the impact of the online world on an individual's wellbeing. The current study attempts to fill this gap by providing one such instrument.

2. Literature review

While there is no standard or popularly accepted definition of wellbeing, there are a number of different perspectives on the construct of wellbeing and how it is to be measured. Alexandrova (2015) identified three schools of thought which differed based on their underlying theories. The first school of thought equates well-being to 'hedonic balance' or the balance between an individual's positive and negative emotions. The second school of thought suggests that wellbeing is a result of the perceived level of life satisfaction. Life satisfaction refers to an individual's subjective judgement of their own life. The third school of thought is based on 'eudaimonia', a concept defined by Aristotle. It suggests that well-being is a product of one's sense of autonomy, mastery, purpose, and connectedness to people (Ryff, 1989; Alexandrova, 2015).

Positive psychology consists of the Hedonistic and Eudemonic traditions (Deci and Ryan, 2008). In the current study, the researchers aim to design a self-assessment instrument of well-being and are thus concerned with subjective wellbeing, a part of the hedonic tradition (Alexandrova, 2015). As per this tradition, subjective wellbeing includes three main dimensions or components of overall life satisfaction, negative affect, and positive affect (Diener & Suh, 1997).

Affect refers to moods and emotions of the individual (Diener & Suh, 1997). Feelings of 'joy', 'pride' and 'happiness' are used to describe positive affect, while negative affect is characterized by emotions such as 'anger', 'anxiety' or 'sadness' (Cacioppo & Berntson, 1999). While the use of terms like positive and negative would suggest that the concepts are opposites and that at a time, an individual can only experience one or the other, this has been proven to be false and literature suggests that they be treated as two dimensions, rather than opposites (Lee & Oguzoglu, 2007). According to Deci and Ryan (2008), a state of subjective wellbeing is usually characterized by a higher positive and lower level of negative affect.

The last dimension refers to overall life satisfaction. Life satisfaction is defined as the result of a cognitive process of evaluation (Diener et al., 1985). Individuals evaluate their own life according to their own set of measures and compare it to what they believe is an ideal life. The result of this evaluation determines their level of life satisfaction (Shin & Johnson, 1978). The life satisfaction score is dependent on three main things; the individual's perception of life at present, the measures identified by the person and their idea of an ideal life.

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Although the concept of subjective well-being has been explored theoretically, the measurement of the concept is now gaining importance. One standardized report that is published annually is the *World Happiness Report* by the United Nations Sustainable Development Solutions Network (SDSN). The report attempts to rank countries by how 'happy' they are (Helliwell et al., 2020). While traditionally, financial measures were relied on to approximate the wellbeing of a nation, the understanding that this system returned inaccurate results led to the increased focus on monitoring well-being through measurement of a nation's 'happiness' (Layard, 2010).

There are numerous general scales that can be used to assess well-being, including the *Teacher Subjective Well-being Questionnaire*, *PostTrans Questionnaire*, and WHO-5 *Wellbeing Index* (Topp et al., 2015). On a five-point scale, participants are asked to score statements in the WHO-5. The scale is different from other scales in that it contains statements like "Over the last two weeks I have felt cheery and in high spirits", and it is intended to be used in a variety of measurement scenarios. The *PostTrans Questionnaire*, for instance, is intended for postnatal patients with type 1 diabetes (Rasmussen et al., 2013). While the *Teacher Subjective Wellbeing Questionnaire* (TSWQ) is specifically designed for teachers (Renshaw et al., 2015). This led to the search for an Online well-being scale. However, the researchers were unable to identify a validated tool that measured well-being in the online context.

The need for a scale to measure the impact of the online environment on an individual's well-being arises mainly due to the increased dependence on the internet. This was further amplified with the pandemic and the associated lockdowns that were imposed. A study by Best et al. (2014) found evidence that supported the proposition that the online world encouraged and supported the efforts of adolescents to create social networks and engage with one another. However, their research also revealed that online communication has a detrimental effect on a person's welfare. The findings of studies based on elderly participants were contradictory. Shapira et al. (2007), in their study of 22 elderly participants found that engaging with computers and the internet made the person feel happier about their quality of life; thereby adding to growing literature that highlights the complexity of the connection between online behavior and subjective well-being (Ong et al., 2021). Several studies have found that excessive use of social media and dependence on the online environment can cause negative mental health outcomes like increased risk of depression and anxiety symptoms (Lin et al., 2016). Prolonged use of digital tools has also been found to impact physical health resulting in back pain, musculoskeletal issues, and increased risk of obesity (Tremblay et al., 2017). In addition, the security issues associated with technology and cyberbullying have also been found to have a strong negative impact on an individual's psychological health (Livingstone et al., 2019).

However, there has also been a positive impact of the use of technology. While researchers have proven that the online world has enabled the creation of stronger and wider social networks, the use of digital technologies such as mobile health apps, online psychotherapy, and virtual reality exposure therapy have shown promising results in improving mental health outcomes. Additionally, social media use has been found to have some positive effects, such as enhancing social support and reducing social isolation (Barros & Sacau-Fontenla, 2021).

Like in any scenario it appears that the use of technology has been both a boon and a bane. What appears to be the question to be answered is how much technology or how would one know when technology, instead of benefiting, is actually harming? While some researchers have chosen to use traditional well-being measures in their studies on the online world, the practice has been termed as a skeuomorph or "an ornamental version of something that was, in an earlier product, a functional necessity. Like fake shutter sounds in digital cameras" (Pogue, 2013, p. 1). Schueller et al. (2013) highlighted the need for a well-being scale, designed for the online environment by explaining that the use of standard measures would limit the scope and validity of studies.

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Thus, in the current study the researchers attempt to design and validate an instrument to measure the subjective well-being of an individual in the online environment. The researchers have drawn inspiration from the traditional scales, but the items are designed to capture the respondent's perception of their level of well-being when actively participating in the online world.

3. Methodology

The methodology of the study is described in this section. The DeVellis (2016) scale development method was employed in the research. Figure 1 illustrates the steps of the procedure. A systematic literature review and a brainstorming session were used to create the initial item pool. The concept needed to be defined first for the same. The impact of technologies and digital services on a person's mental, physical, and emotional health is how the researchers operationalized digital well-being based on their literature review.

The definition and the items were then discussed with the panel of experts and their views were sought on what items are to be retained, deleted, and modified. Based on the feedback the items were accordingly modified and the pilot test was carried out. The purpose of the pilot test was to ensure that there was no difficulty in collecting data and understanding the statements. Post the pilot test, the questionnaire was rolled out and a total of 301 usable responses were collected.

Purposive sampling was used to identify potential participants and only those who were digitally active or spent more than 4 hours in an online environment or on a device were allowed to participate. This was done to avoid outliers as in the study by Shapira et al. (2007). The majority of the sample belonged to the age groups of 21 to 30 years of age.

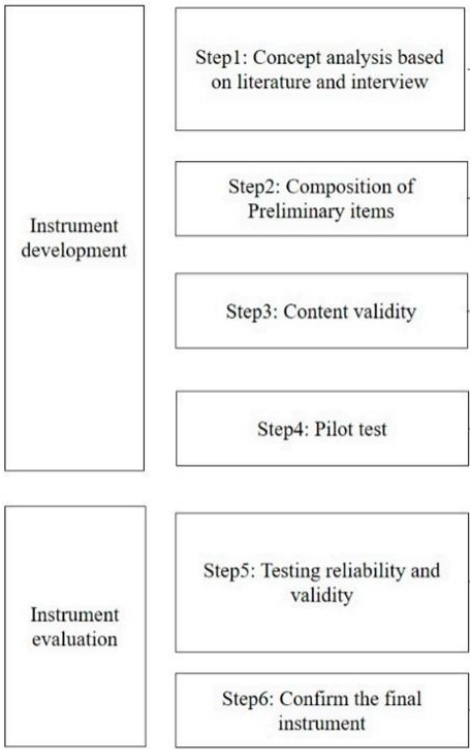

Figure 1. Steps in the designing of the scale (Shyamamala et al., 2021)

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4. Results

The scale design and validation were completed in the manner described below.

Concept Analysis

A review of the literature on well-being was required as the first step in the design process. According to an assessment of commonly used scales in the area, statements should fit into one of four categories: physical, mental, social, or emotional. Thus, the researchers proceeded to identify the indicators or statements under each dimension.

Content validity

A panel of 7 experts established the scale's content validity. Three specialists from the research field were picked, three positive psychology experts were contacted, and one language expert was asked to examine the language and grammar. Then, after considering the experts' comments, the statements were changed. At this point, there were 20 items in the scale.

Analysis of distribution

The collected data was cleaned and coded in Excel before the analysis. As explained in the methodology section, the researchers identified statements under the dimensions of Social, Mental, Physical and Emotional. The descriptive statistics of the dimensions are presented in Table 1.

Table 1. Descriptive statistics.

	N	Mean	Std. Deviation	Skewness	Kurtosis
SocilDW	301	3.00	.966	-.099	-.538
MentalDW	301	3.03	.892	-.314	-.331
PhysicalDW	301	3.12	.828	-.398	-.037
EmotionalDW	301	2.89	.774	.114	.009

The skewness and kurtosis values were found to be within the range of +3 and -3. The skewness and kurtosis values suggest that the data can be treated as normally distributed and that parametric tools for analysis can be used.

Reliability Analysis

The reliability of the proposed scale was checked through the Cronbach's alpha value (Table 2). The scale was found to have a reliability score of 0.921, which is above the threshold value of 0.7.

Table 2. Reliability of the scale.

Cronbach's Alpha	N of Items
.921	20

Exploratory Factor Analysis

The next step was to conduct an exploratory factor analysis (EFA) to determine the scale's dimensions. The results of the EFA are presented in Table 3 and 4.

Table 3. KMO and Bartlett's Test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.930
Bartlett's Test of Sphericity	Approx. Chi-Square	3394.628
	df	190
	Sig.	0.000

The sample may be considered adequate for analysis, according to the KMO score. The results of the Bartlett's Test of Sphericity are significant, which implies that there is at least one significant strong correlation between the items.

Table 4. Rotated Component Matrix.

	Component		
	1	2	3
DW4	.782		
DW9	.759		
DW13			.506
DW3	.652		
DW6	.557		
DW7			.589
DW11	.540		
DW2	.620		
DW5	.806		
DW15		.776	
DW16		.825	
DW17		.855	
DW18		.831	
DW1			.816
DW8	.713		
DW10			.625
DW12	.791		
DW14	.754		
DW19	.522		
DW20			
Extraction Method: Principal Component Analysis.			
Rotation Method: Varimax with Kaiser Normalization.			

The principal component approach with varimax orthogonal rotation was used to conduct the EFA. The findings imply that there are three principal components to the scale. The first factor consists of 12 indicators; the second and third factors each consist of four indicators. Instead of the four dimensions that were first suggested, the rotated component matrix transferred the statements to three dimensions. To determine and name the dimension, the statements under each dimension were further examined. Following a discussion with our expert panel, the dimensions were assigned labels. Table 5 presents the dimensions and the associated statements.

Table 5. Dimensions of the Digital Well-being Scale (DWS).

Dimension	Items
Mental	I feel I am productive when I am online
	Being online helps me relax
	I feel more connected to other people when I am online
	The online environment makes me feel energetic
	I find that my problem-solving skills have improved since going digital
	The online environment makes me feel good about myself
	Being online helps me feel closer to other people
	Access to the online world has made more decisive
	Being online makes me feel loved
	I feel cheerful when I am connected online
	The online resources make me feel more in control of my life
	I feel uncomfortable when disconnected from the online environment
Emotional	Access to online resources makes me feel optimistic about my future
	Online resources help me think more clearly
	Access to online resources makes me feel confident
	Being online has made me interested in new things
Physical	I feel spending time online has affected my sleep patterns
	Spending more time on the online environment has impacted by eating habits
	Being online has added to my physical discomforts like aches and pains
	Being online implies that I have lesser physical exercise

Confirmatory Factor Analysis

In order to evaluate the latent constructs, a confirmatory factor analysis, or CFA, was performed. Goodness-of-fit, convergent validity, and discriminant validity were also established using CFA. The model's fit indices are displayed in Table 6.

Table 6. Model fit indices.

	(χ2/df)	GFI	AGFI	RMR	RMSEA
Model Value	2.86	0.902	0.826	0.042	0.07
Accepted Value	< 3	> 0.90	> 0.80	<0.05	<0.10

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The model is well-fitted, as shown by the model fit indices. The RMR and RMSEA values were discovered to be below the threshold limit, and all of the goodness-of-fit indices were found to meet the necessary requirements. The validity ratings are shown in Table 7.

Table 7. Measures of validity.

	CR	AVE	MSV	ASV
Physical	0.994	0.977	0.1764	0.1560
Emotional	0.819	0.946	0.1369	0.0625
Mental	1.049	2.228	0.1764	0.0210

The average variance extracted (AVE) score and the composite reliability (CR) score were used to evaluate the converging validity. All of the dimensions' CR scores were discovered to be higher than the permissible level of 0.7. (Brown, 2015). Physical, emotional, and mental AVE scores were discovered to be more than the cutoff point of 0.5. (Brown, 2015). By comparing the MSV and ASV scores of the dimensions to the AVE scores of the corresponding dimension, the discriminant validity was determined. The researchers draw the conclusion that the requirement of discriminant validity is satisfied because the Maximum Shared Variance (MSV) and Average Shared Variance (ASV) scores were discovered to be lower than the AVE values.

5. Discussion

As interest in understanding the interaction between human beings and digital tools increases, it becomes essential to have a standard scale for measuring online well-being of an individual, rather than depending on researchers to identify and use measurement tools, which may or may not be tested (Ong et al., 2021). The absence of an instrument measuring the subjective well-being of an individual in the online environment motivated the researchers to design and validate an instrument to measure the same and attempt to fill a critical gap in the literature.

The researchers created an item pool through a systematic review of literature, followed by a brainstorming session. The item pool was further analyzed by a panel of experts. Based on their suggestions, items were retained, deleted, and modified and sent for pilot testing. Four dimensions, Social (M=3.00 SD=.966), Mental (M=3.03 SD=.892), Physical (M=3.12 SD=.828) and Emotional (M=2.89 SD=.774) were identified by the researchers based on the review of literature. The scale returned a reliability score of 0.921.

A total of 301 respondents made up the sample, and KMO values of 0.930 indicated that the sample was sufficient for the analysis (p 0.05). The rotational component matrix projected the assertions to three dimensions, contrary to the literature's suggestion that the scale had four dimensions. With a total of 20 items, the dimensions were renamed as Mental, Physical, and Emotional. The model's GFI value of 0.902 was deemed to be a good fit. It was discovered that the RMR and RMSEA values were below 0.05 and 0.10, respectively.

The last step was to establish convergent and discriminant validity. It was found that the composite reliability score and average variance extracted score were above 0.7 and 0.5 (Brown, 2015) respectively. To establish the discriminant validity the Maximum Shared Variance (MSV) and Average Shared Variance (ASV) scores were compared with the AVE score of the related dimension. Both MSV and ASV were found to be below the AVE scores suggesting that the scale fulfilled the requirement of discriminant validity.

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The internet has become an important part of our lives and one can see an increase in the presence of individuals in virtual space (Lee et al., 2022). An American study revealed that on an average an individual spends 144 mins on the internet (Dixon, 2022). This has impacted their physical health as the time they spend online would otherwise have been utilized for physical activity, eating, or socializing (Bureau of Labor statistics, 2020). In another study it was found that adults spending more time on social media have higher levels of C-reactive protein (CRP) and interleukin (IL)-6 biomarkers of chronic inflammation (Lee & Way, 2021).

Larger screen time has a negative impact on the sleeping patterns of an individual. Lack of sound sleep, insomnia are common symptoms of online addiction (Jenaro et al., 2007; Woods et al., 2016). Poor quality of sleep can impact the physical health and elevate the risk for cardiovascular disease (Buxton et al., 2010) high blood pressure (Vgontzas et al., 2009) and can even cause early death (Kripke et al., 2002). The studies are in line with the fact that the more an individual spends time on digital space the more detrimental it is to their physical health.

Being in digital space for a longer duration of time can also have an adverse effect on the mental and emotional health of an individual and can cause anxiety and depression (Drouin et al., 2018). Charoensukmongkol (2018) found that the mental well-being of an individual is greatly impacted by the time spent on social networking sites. Sharing, reading, or posting content on digital platforms increases stress levels (Tang & Lee, 2013). The stress levels were found to increase as individuals shared and read all kinds of information; politics, economics, social or personal issues (Weng & Menczer, 2015).

Initially people got attracted to the digital space as it acted as a cushion for coping up with stress (Charoensukmongkol, 2018) later it became the major contributor of stress (Fleck & Johnson-Migalski, 2015). The content viewed by an individual changes the mood of a person. This individual can in turn impact the mood of others through comments or pictures shared (Chukwuere & Chukwuere, 2017).

In today's world individuals are largely dependent on the online world and the pandemic has further increased our dependency. People were locked in their homes and their offline social interactions were limited. While initially, the online environment helped them feel connected to their friends, it had major effects on the physical, emotional, and mental wellbeing of individuals. Thus, there is a growing need to understand and measure the digital wellbeing of an individual. Efforts should be made by organizations as well as by nations to understand and promote the mental and physical wellbeing of their people and steps should be taken to reduce the negative impact of the digital world.

The current tool is a small step in that direction. However, the respondents of the current study belong to the age group of 21 to 30 years. Probably, there would be a need to modify the scale for other age groups. Different generations utilize or interact with technology differently. Thus, the way they use technology, their concerns and their benefits would differ (Kafaee et al., 2021). While the current tool may hold valid for all age groups, it would be best to test the tool across age groups to establish validity. Additionally, slight variations of the tools may prove sufficient for measuring digital well-being across age groups.

Another area that could be explored, based on the findings of the current study is the dimension of social well-being. The scale was originally designed keeping in mind four dimensions of Social, Physical. Mental and Emotional. This was based on the various definitions of wellbeing that were reviewed. However, the final scale identified only three dimensions, which experts identified as mental, emotional, and physical. The absence of the social dimension may be explained due to its strong correlation to mental and emotional health. Good, strong social connections have been known to alleviate mental health issues like anxiety and depression, while also having a strong impact on self-esteem and sense of self-worth (Kansky, 2017). However, a re-test of the tool in a different demographic would help in understanding the dimensions better.

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6. Limitations of the study

Limitations of the present study include the following. First, the study uses self-reported data and response bias could exist. Second, the respondents of the current study mainly belonged to the age group of 21 to 30 years. Given the increase in the use of digital tools and the online environment in schools, a study on the subjective digital wellbeing of school students would help teachers and schools to cater to the needs of their students better. Similarly, the instrument would have to be tested on a population greater than 30 years of age. The validity of the instrument would further be enhanced if the instrument is tested in different contexts.

7. Conclusion

There has been an exponential increase in the time spent by individuals in the virtual worlds. While the increased time has allowed individuals to connect with friends and family during a time of despair, it has also been found to have an impact on the mental, physical, and emotional wellbeing of individuals. While the interaction between human beings and the virtual world has been of interest to researchers for some time now, the absence of a well validated scale to measure digital wellbeing has forced researchers in the past to use traditional wellbeing scales.

The current study aimed to fill this gap by designing and validating a digital wellbeing scale. The researchers used the DeVellis (2016) method for scale development. The final instrument contains 20 items that measure the dimensions of Physical, Mental and Emotional wellbeing. The instrument was checked for reliability and validity and was found to fulfil the requirements. The researchers hope that a valid digital wellbeing scale would not only encourage researchers to study the human-computer-virtual world interaction but would also help institutions, organizations, and societies to measure and manage the wellbeing of their people.

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Roseline Gomes is currently working as an Assistant Professor at the Jyoti Nivas Autonomous College. Her areas of interest include Mental Health, Development and Learning.
Contact: roseline.gomes@res.christuniversity.in

Jain Mathew is currently working as a Professor and Dean of the School of Business and Management, CHRIST University. His areas of interest include Well-being, Leadership and Learning.
Contact: jainmathew@christuniversity.in

Sridevi Nair is currently working as an Assistant Professor at the School of Business and Management, CHRIST University. Her areas of interest include Well-being, Gamification and Learning.
Contact: sridevi.nair@res christuniversity.in.

Ankita Mulasi is currently working as an Assistant Professor at the Presidency University. Her areas of interest include Behavioural Finance and Investment Behaviour
Contact: ankita.mulasi@res.christuniversity.in

Preksha Yadav is currently working as an Assistant Professor at the CMR Institute of Technology. Her areas of interest include Green Human Resource Management and Sustainability
Contact: preksha.yadav@res.christuniversity.in