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Validity and reliability of digital self-efficacy scale in Iranian sample

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ABSTRACT

Background and Aim: The digital self-efficacy scale was prepared and developed in 2022 by Ulfert and Schmidt in order to measure the subject's competencies in using digital technologies. This scale consists of 25 items and measures digital self-efficacy in five dimensions, which are: 1) information and data literacy; 2) collaboration and communication; 3) production of digital content; 4) security; 5) Problem-solving. The purpose of the present study was to investigate the validity and reliability of the digital self-efficacy scale in the Iranian sample. **Methods:** The current research was applied in terms of purpose and validation research. The current research was a quantitative study in which validity and reliability determination methods were used to validate the digital self-efficacy scale. The statistical population of the present study included all students of Islamic Azad University, South Tehran branch, who were studying in the 2022-2023 academic year. The statistical sample of this research included 500 students who were selected by the available sampling method and completed the questionnaire. In order to statistically analyze the data, confirmatory factor analysis, exploratory factor analysis, KMO and Bartlett test, Cronbach's alpha, combined reliability coefficient (CR) and Pearson correlation coefficient were used. Statistical analysis of data was done with SPSS software version 23. **Results:** After confirming the face validity, 5 factors with a greater eigenvalue of 1 were identified through exploratory factor analysis, so that the 5 factors obtained in total were able to explain 70.55% of digital self-efficacy. Confirmatory factor analysis also showed the significance of the items of all 5 factors. Moreover, the coefficients obtained for convergent validity, test-retest reliability, Cronbach's alpha and composite reliability were all higher than 0.70, which indicates the appropriate reliability of this questionnaire. **Conclusion:** It can be concluded that the digital self-efficacy scale has good validity and reliability.

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Introduction

Due to the ever-increasing growth of technology and information technology, the opinion of researchers in the field of psychology has also been drawn to this field. Therefore, the conceptualization of variables and the construction of scales to measure these variables are very important to advance studies in this field (Ulfert-Blank and Schmidt, 2022; Stephen et al., 2020; Parsakia et al., 2023; Malodia et al., 2023; Maran et al., 2022; Tetri & Juujarvi, 2022; Lau et al., 2022; Han & Reinhardt, 2022; Yu & Hu, 2022; Taba et al., 2022; Bonanati & Buhl, 2022).

In this regard, knowledge and skills related to digital devices and various software have become one of basic skills in modern societies (Ulfert et al., 2022). Research has shown that not only objective skills play a role in the effective use of digital tools, but also mental components (Peiffer et al., 2020). In particular, studies support the effect of self-efficacy on the effective use of digital systems and their prediction (Ulfert et al., 2022). Also, based on the suggestion of previous research, the construction of the concept of self-efficacy in specific areas has higher predictive power than the general scale of self-efficacy (Tetri & Juujarvi, 2022). Self-efficacy was first introduced by Albert Bandura (1986) and is generally defined as a person's perceptions of his abilities and capabilities in performing tasks (Bandura, 1986). Self-efficacy is widely considered one of the most important determinants of a person's capabilities in responding to unfamiliar challenges and situations (Santoro, 2020). A high level of self-efficacy makes people expect better outcomes, have a greater desire to identify and use opportunities around them and make more efforts to overcome problems and obstacles (Bandura, 2012; Maran et al., 2022). Therefore, many approaches have been proposed to evaluate self-efficacy. These approaches cover a wide range from self-efficacy in a specific task, or a specific domain to general self-efficacy (Marsh et al., 2017). In this regard, especially in the past year, many researchers have investigated the role of self-efficacy in the world of technology and the use of digital tools. For example, Maran et al. (2022) found that self-efficacy in using digital tools plays a significant role in success in recruitment and employment. Tetri & Juujarvi (2022) showed that self-efficacy and self-efficacy in using the Internet can predict the use of digital health and social services. They concluded that people who have higher self-efficacy in using the Internet have higher mental and physical health due to more and better use of digital services. Taba et al. (2022) showed that teenagers have low self-efficacy in using this information due to dealing with terms that make it difficult to understand health-related information on the Internet, so they rarely go to this information voluntarily.

In the past, scales have been made to measure Computer self-efficacy computer and Internet self-efficacy, but recently, the attention of researchers has been drawn to the evaluation of self-efficacy in the field of communication and information technology, so many scales focus on it. It should be noted that these scales include both Internet and computer self-efficacy, which was discussed in the past (Ulfert & Schmidt, 2022).

Ulfert & Schmidt (2022) created a comprehensive scale called the digital self-efficacy scale by reviewing previous research related to different measurement tools in the mentioned fields. They believe that the existing tools are either of very limited use or, on the other hand, there are tools that, despite the fact that they can be used in more situations, none of them consists of dimensions that can give a high comprehensiveness to the measurement tool. Therefore, after reviewing previous research and adding new items, Ulfert & Schmidt (2022) prepared a digital self-efficacy scale that measures digital competencies in five dimensions; 1) information and data literacy; 2) collaboration and communication; 3) production of digital content; 4) security; 5) Problem-solving. Information literacy includes searching, evaluating, managing and having an attitude towards data and digital content. Communication and collaboration include interaction, sharing and participation in digital technologies. It also includes ethics and digital identity management. Digital content creation includes the development, creation, integration, interpretation and revision of digital content. In addition, it also includes programming and compliance with copyright law. The security dimension includes the protection of information and privacy, health and well-being, environment and digital tools. Finally, the problem-solving dimension consists of solving technical problems, identifying needs and

responding to needs through technology, creativity in using technology, and identifying digital competency gaps.

Therefore, according to the mentioned materials, the purpose of the present study was to investigate the validity and reliability of the digital self-efficacy scale in the Iranian sample.

Method

The current research was applied in terms of purpose and validation research. The current research was a quantitative study in which validity and reliability determination methods were used to validate the digital self-efficacy scale. The statistical population of the present study included all students of Islamic Azad University, South Tehran branch, who were studying in the 2022-2023 academic year. The statistical sample of this research included 500 students who were selected by the available sampling method and completed the questionnaire. In order to statistically analyze the data, confirmatory factor analysis, exploratory factor analysis, KMO and Bartlett test, Cronbach's alpha, combined reliability coefficient (CR) and Pearson correlation coefficient were used. Statistical analysis of data was done with SPSS software version 23.

Materials

1. Digital self-efficacy scale: This scale was prepared and formulated in 2022 by Ulfert and Schmidt in order to measure the subject's competencies in using digital technologies. This questionnaire consists of 25 items and measures digital self-efficacy in five dimensions, which are: 1) information and data literacy (3 items); 2) collaboration and communication (8 items); 3) production of digital content (4 items); 4) security (5 items); 5) problem-solving (5 items). The items of this scale are scored based on a 6-point Likert scale. Therefore, the overall score of this questionnaire is in the range of 25 to 150. Moreover, the score of the subscales of information and data literacy is in the range of 3 to 18, collaboration and communication in the range of 8 to 48, digital content creation in the range of 4 to 24, and security and problem-solving are both in the range of 5 to 30. The validity of this questionnaire was checked and verified by its creators using the methods of face validity, convergent validity, divergent validity and confirmatory factor analysis method. The reliability of this scale was also confirmed using the test-retest method. The correlation coefficient for the reliability of this scale was calculated by the test-retest method; The correlation coefficient for data and information literacy subscales was 0.59, communication and collaboration were 0.59, digital content creation was 0.77, security was 0.68, and problem-solving was 0.71.

Implementation

First, the questionnaire was translated into Farsi by the authors of this article, and then, after putting the translations together and revising, and with the agreement of all three people, one version was prepared. The final translated version was reviewed and revised by 7 professors and experts in this field and the necessary corrections were made. In the end, it was carefully examined in a focus group of 12 people and the final corrections were applied to it. Thus, after verifying the face validity, the sampling process was completed by 500 people and the collected data was entered into the SPSS software. Finally, the collected data were analyzed using descriptive and inferential statistics, the results of which are presented below.

Results

The demographic findings of the present study showed that the average (standard deviation) age of the subjects was 21.83 (5.43). Moreover, the findings indicated that 327 (65.4%) of the participants were female and 173 (36.4%) were male.

In order to use exploratory factor analysis, KMO test and Bartlett's sphericity test were performed first. The results showed that the KMO coefficient is equal to 0.816 and the chi-square value in Bartlett's sphericity test is 2789.66, which is significant at the 0.001 level.

Therefore, according to the results of KMO test and Bartlett's sphericity test, exploratory factor verification can be used.

Table 1. Results of exploratory factor analysis of digital self-efficacy scale

Factor	Special value	Percentage of explained variance	Cumulative variance percentage
1	1/94	11/86	11/86
2	2/11	13/03	25/06
3	2/30	13/67	38/73

4	2/45	14/59	53/32
5	2/83	17/23	70/55

According to the results reported in the above table, in the present study, 5 factors with a greater eigenvalue of 1 were identified through exploratory factor analysis, so that the 5 factors obtained in total were able to explain 70.55% of digital self-efficacy. In the following table, the factor load of each of the items in each of the 5 obtained factors is presented.

Table 2. Results of confirmatory factor analysis of digital self-efficacy scale items

Item	Factor	Factor Loading
7	Data and information literacy	0/82
2		0/70
10		0/66
4	Collaboration and Communication	0/84
1		0/80
8		0/77
5		0/76
21		0/72
16		0/70
11		0/62
24		0/58
3	Digitan content creation	0/82
25		0/78
20		0/62
17		0/50
19	Security	0/85
13		0/80
23		0/73
6		0/66
15		0/53
9	Problem-solving	0/79
12		0/70
18		0/69
14		0/60
22		0/56

The results reported in the above table show that all items have a favorable factor load. Therefore, it can be concluded that none of the items should be removed from the questionnaire. Therefore, the construct validity of the questionnaire was confirmed through exploratory and confirmatory factor analysis. In the following, the results of concurrent validity and reliability of the questionnaire are reported.

Table 3. Results of concurrent validity, test-retest reliability, Cronbach's alpha and composite reliability of digital self-efficacy scale

Component	Concurrent validity	Test-Retest	Cronbach's Alpha	CR
Data and information literacy	0/88	0/81	0/83	0/86
Collaboration and Communication	0/87	0/88	0/84	0/83

Digital content creation	0/80	0/84	0/90	0/84
Security	0/92	0/85	0/85	0/80
Problem-solving	0/87	0/83	0/84	0/82
Total	0/88	0/90	0/90	0/86

To measure the concurrent validity of the research, the Pearson correlation coefficient was calculated between the scores of male and female subjects. Therefore, the correlation coefficient between the scores between the two groups for the whole scale was 0.86. In addition, 0.88 was obtained for data and information literacy, 0.87 for collaboration and communication, 0.80 for digital content creation, 0.92 for security, and 0.87 for problem-solving ($P < 0.001$). In this way, the concurrent validity of the questionnaire was confirmed.

Moreover, to measure the reliability of the questionnaire, the test-retest method was used, the results of which are reported in the above table. As can be seen, the correlation coefficient between the subjects' scores for the entire scale was reported as 0.90. Moreover, 0.81 was obtained for data and information literacy, 0.88 for collaboration and communication, 0.84 for digital content creation, 0.85 for security, and 0.83 for problem-solving ($P < 0.001$). Therefore, the reliability of the questionnaire was confirmed by the test-retest method.

In addition, Cronbach's alpha was also used to measure the reliability of the questionnaire, the results of which are presented in the above table. Cronbach's alpha was calculated as 0.90 for the entire scale, 0.83 for data and information literacy, 0.84 for collaboration and communication, 0.90 for digital content creation, 0.85 for security, and 0.84 for problem-solving. Therefore, considering that the alpha values for the whole scale and all subscales were higher than 0.70, it can be concluded that the questionnaire has good reliability.

Finally, composite reliability was used to measure the reliability of the questionnaire, the results of which are reported in the above table. Composite reliability was calculated for the entire scale as 0.86, for data and information literacy as 0.83, for collaboration and communication as 0.84, for digital content creation as 0.81, for security as 0.80 and for problem-solving as 0.82. Therefore, considering that the combined reliability values for the whole scale and all subscales were higher than 0.70, it can be concluded that the questionnaire has good reliability.

Conclusion

The purpose of the present study was to investigate the validity and reliability of the digital self-efficacy scale in the Iranian sample. For this purpose, face validity, exploratory factor analysis, confirmatory factor analysis and concurrent validity were used to measure the validity of the questionnaire. Cronbach's alpha, combined reliability coefficient and test-retest method were used to measure the reliability of the questionnaire. The results obtained from the data analysis showed that the digital self-efficacy scale has good validity and reliability.

The face validity of the questionnaire was confirmed by the professors and experts of this field before the distribution of the questionnaires and after several stages of modification and revision in the questionnaire. Moreover, exploratory factor analysis showed that this questionnaire consists of 5 valuable factors, and confirmatory factor analysis also confirmed the role of each of the items in the 5 discovered factors. These results are in line with the research done by the creators of the questionnaire. In their research, Ulfert and Schmidt (2022) confirmed the significance of the questionnaire items using confirmatory factor analysis, but did not use exploratory factor analysis. Instead, it can be acknowledged that the results of exploratory factor analysis in this study are in line with the model fitting results obtained in the study of Ulfert and Schmidt (2022). In other words, the creators of the questionnaire first examined the 5 desired factors through confirmatory factor analysis and checked the significance of the 5 factors of their scale using model fit indices. Therefore, it can be said that the results obtained from the exploratory factor analysis in this research are in line with the fitting results of the research model of the scale makers. Moreover, the concurrent validity of the questionnaire was confirmed in this research, and this result can be

considered consistent with the result obtained from convergent and divergent validity using demographic characteristics in the research of questionnaire makers.

The reliability of the digital self-efficacy scale in the present study was measured by Cronbach's alpha, test-retest and composite reliability methods. Based on Cronbach's alpha and combined reliability, it indicated that all the obtained values showed a number greater than 0.70, which indicates good reliability of the questionnaire. Finally, the value of the correlation coefficients obtained in the test-retest method for all subscales and the whole scale was significant ($P < 0.001$). This result is in line with the results obtained by Ulfert and Schmidt (2022) in the test-retest reliability of the questionnaire. Therefore, considering that the reliability of the questionnaire was confirmed by three methods, it can be concluded that the digital self-efficacy scale is reliable.

Nevertheless, the present research had limitations, like any other research, among these limitations, the following can be mentioned: 1) The statistical population used in the present research included students of Azad University, South Tehran branch. Therefore, the validity and reliability of the questionnaire cannot be generalized to the rest of the statistical communities. 2) The instrument used in the present study was a self-report type. The results obtained from the self-reporting tool are always accompanied by various errors. These errors can be caused by the dishonesty of the respondent, the prevailing conditions when completing the questionnaire, inaccuracy in answering, or the respondent's lack of complete knowledge of himself. Therefore, considering the limitations of the research, future researchers are suggested to re-examine its reliability and validity while using the digital self-efficacy scale in their studies.

Ultimately, according to the obtained results confirming the validity and reliability of the digital self-efficacy scale, it is suggested to use this questionnaire as a new measurement tool in academic, occupational, clinical and couple therapy situations.

Conflict of Interest

According to the authors, this article has no financial sponsor or conflict of interest.

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