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EXAMINATION OF DIGITAL LITERACY SKILLS OF UNDERGRADUATE STUDENTS ACCORDING TO VARIOUS VARIABLES[1]

Sibel Yoleri,[2]
Assist. Prof. Dr., Education Faculty, Department of Preschool Education,
İzmir Democracy University, Turkey

sibel.yoleri@idu.edu.tr
ORCID: 0000-0002-7802-2352

Zeynep Nur Anadolu,[3]
Master Student, Education Faculty, Department of Preschool Education,
İzmir Democracy University, Turkey

zeynepanadolu35@gmail.com
ORCID: 0000-0002-6546-9315

Abstract. *The purpose of this research was aimed to determine the digital literacy skills of undergraduate students studying in different departments of the university according to the variables of gender, type of faculty, and daily internet use. In order to achieve this goal, 388 undergraduate students studying at the Faculty of Education, Faculty of Health Sciences, and Faculty of Economics and Administrative Sciences at İzmir Democracy University were determined as participants. The "Personal Information Form" prepared by the researchers and the "Digital Literacy Scale (DLS)" developed by Bayrakcı & Narmanlıoğlu (2021) and consisting of six sub-dimensions were used as data collection tools. According to the findings of the research, it was determined that the digital literacy levels of the students were moderate. When examined according to the gender variable, a significant difference was found between female and male students in the sub-dimensions of digital literacy levels. When examined according to the faculty variable, it was determined that there was a significant difference between the sub-dimensions of digital literacy levels, Daily Use, Professional Production, and Privacy and Security. As a result of the research, according to the daily internet usage variable, a significant difference was found between the General Knowledge and Functional Skills sub-dimensions of the digital literacy levels of the students according to the daily internet usage time. It is expected that the results obtained will*

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[2] Corresponding author, responsible for conceptualization, methodology, writing an original draft, reviewing and editing.
[3] Co-author, responsible for data curation, investigation.

contribute to the literature and draw attention to the development of digital literacy skills of university students.

***Keywords**: digital literacy; digital skills; digital competence; technology; undergraduate students.*

1. INTRODUCTION

At present, the frequency of use of technology and new digital trends has increased, and it continues to increase, and in the century, we live in, new skills are needed to meet today's expectations in daily and business life. Developments transform our lives and cause our skills to be shaped (Furman, 2015). For this reason, the Partnership for 21st Century Skills (P21) competency and skills framework has been prepared by gathering more than one association and company in the USA. When P21 is examined, it is seen that Information, Media & Technology Skills dimension includes a set of functional skills such as information literacy, media literacy, and ICT (Information and Communication Technologies) literacy (Partnership for 21st Century Skills, 2019). The digital literacy skill, which is included in the P21 skills, is expected to follow continuous change without being constant simultaneously with the speed of technology (Law et al., 2018).

Digital literacy has become indispensable for every world's citizen and integrated part of education, health sciences, media, etc. different fields (Benson, & Kolsaker, 2015; McDougall, Readman & Wilkinson, 2018). It is important to have digital literacy skills to find, create, share, and use the right information effectively with different technologies (Hamutoğlu et al., 2017). On the other hand, the widespread use of digital devices has resulted in an increased need for acquiring digital literacy skills.

The concept of digital literacy was first used by Paul Glister. According to Gilster (1997), digital literacy is a special mental skill associated with being able to reason rather than just pressing keys. Eshet-Alkalai (2004) defines digital literacy as "the ability to survive in the digital world". According to Acar (2015), digital literacy is about the safe, legal, and moral use of these technologies, while contributing to the personal development of the individual with these technologies, solving the problem in any context of life, supporting social participation and production, and providing the embodiment of all these. In their research, Bayrakcı and Narmanlıoğlu (2020) define digital literacy as the competence to use digital technologies effectively in social, economic, and cultural areas and to be aware of possible risks. This definition includes the following statements:

Social Dimension; e.g. Individual Media, Publishing, Web Design, and Publishing Partnership

Ethics and Responsibility; e.g. Digital Rights, Content Awareness, Digital Responsibility

General Knowledge and Functional Skills; e.g. Hardware and Software Information, Network Knowledge, and Practice

Daily Usage; e.g. E-citizenship, Digital Transactions (shopping, browsing, etc.)

Professional Production; e.g. Software and Project Development, Coding

Privacy and Security; e.g. Protection of Personal Data, Creating a Strong Password.

Based on this information, the basic skills that a digitally literate person should acquire are listed below: being able to use a computer at the beginner level and to be able to access it in daily use; to scan, produce and evaluate information with the aim of research and content learning; to protect himself/herself properly against possible phishing and personal rights violations in digital environments; to use and develop technological tools competently to solve problems and create creative ideas for various problems that may arise (Ng, 2012).

Various studies have been carried out with the understanding of the importance of digital literacy both in Turkey and in the world. For example, United Nations International Children's Emergency Fund-UNICEF (2017) emphasized the necessity of digital literacy course education. In Turkey, the Movement to Increase Opportunities and Improve Technology Project was developed in 2012 by the Ministry of National Education regarding the inclusion of technology in the learning-teaching process (Direkçi et al., 2019). At the same time, the “Turkey Competences Framework” was prepared for students, and “Digital Competence” was determined as one of 8 competencies (Ministry of National Education, 2018). At the same time, digital literacy courses started to be taught in pilot universities in 2019 (Council of Higher Education, 2019). On the other hand, various studies have been conducted on the importance of digital literacy. For example, Ahmed and Roche (2021) examined the effect of digital literacy skills on the academic achievement of undergraduate students at a university in the United Arab Emirates. As a result of the research, it was determined that general device ownership and access status had a positive effect on students' digital literacy skills. At the same time, they found that students with high digital literacy contributed to their academic success. In addition, it has been determined that it gives the students the opportunity to meet new tools within the scope of the study and that the students do not hesitate when starting to use these tools. Timur, Timur and Akkoyunlu (2014) found in their study that the digital literacy levels of the participants increased as the time they spent on social networks increased. Göldağ (2021), on the other hand, found that students with high digital literacy skills had positive results as their computer ownership, daily computer use, and digital device usage levels increased. In another study by Lokmic-Tomkins et al. (2022), they focused only on the digital literacy skills of nursing students. The study group consists of nursing undergraduate and graduate students. As a result of the research, it was found that nursing students are frequent internet and social media users. In addition, despite the positive attitudes towards digital technology and the widespread presence of digital technology in students' lives, it has been determined that there are deficiencies in students' confidence in using digital technology and the software necessary for learning. In the study conducted by Morgan et al. (2022), the digital literacy skills of 324 undergraduate students studying in the business department of a university in Western Australia were examined. They concluded that students' cognitive dimensions regarding the use and access of digital information, and their competence in etiquette (copyright, ethics, etc.) were low. On

the other hand, it has been determined that the students have a high level of proficiency in the sub-dimensions of professional online behaviour, online communication, and cyber security. The main goals of these projects and studies are for digital individuals who can adapt to the world where digitalization increasing and ensure the development of digital literacy (European Union, 2021; Partnership for 21st Century Skills, 2019).

Purpose and Importance of the Research

The study is important in terms of determining the digital literacy levels of undergraduate students and their deficiencies, if any, and preparing support education and programs according to the results to be obtained. In the literature review, although studies were carried out in the determined faculties, no other study was found that evaluated the three faculties together. The study aimed to examine the digital literacy levels of undergraduate students and these digital literacy levels in terms of gender, type of faculty, and daily internet usage time variables. In this context, answers to the following questions were sought within the scope of the research:

- What is the digital literacy level of university students?
- Do the participants' digital literacy scores show a statistically significant difference in terms of the "Gender" variable?
- Do the participants' digital literacy scores show a statistically significant difference according to the "Types of Faculty" variable?
- Do the digital literacy scores of the participants show a statistically significant difference according to the "Daily Internet Usage Time" variable?

2. METHODS

2.1. Research Model

This research was carried out in accordance with the relational research model, which is one of the quantitative research models. The relational research model is based on determining whether there is a relationship between two or more variables or the degree of influence of one change on the other (Karasar, 2006). One of the most important purposes of such studies is to understand important behaviours by revealing the relationships between variables if any (Fraenkel et al., 2012). The reason for using this method in the study is that the relationships between the variables in the research will be examined.

2.2. Study Group/ Population-Sample

The study group of the research consists of 388 undergraduate students studying in different departments of Izmir Democracy University Faculty of Education, Faculty of Health Sciences and Faculty of Economics and Administrative Sciences in the 2021-2022 academic year. The demographic characteristics of undergraduate students included in the study are presented in Table 1.

Table 1. Demographic information of the study group

Demographic Information		*n*	*%*
Gender	Female	275	70.9
	Male	113	29.1
Faculty	Education	174	44.8
	Health Sciences	116	29.9
	Economics and Administrative Sciences	98	25.3

When the demographic characteristics of the undergraduate students in the research group are examined, it is seen that 70.9% (275) of the 388 participants were female and 29.1% (113) were male. 44.8% (174) of the participants are education faculty, 29.9% (116) in health sciences, faculty, and 25.3% (98) are economic and administrative sciences faculty students.

2.3. Data Collection Tools

In the study, the "Personal Information Form" prepared by the researchers and the "Digital Literacy Scale (DLS)" developed by Bayrakcı and Narmanlıoğlu (2021a) were used as data collection tools.

Personal Information Form

In this form prepared by the researchers, there are questions about the variables of gender, faculty type and daily internet usage time for undergraduate students.

Digital Literacy Scale (DLS)

“Digital Literacy Scale” developed by Bayrakcı & Narmanlıoğlu, (2021a) was used. The related scale was developed as a scale with 29 items and 6 sub-dimensions. It was prepared in the type of a 5-point Likert Scale. [(5) Strongly agree, (4) Agree, (3) Undecided, (2) Disagree, (1) Strongly Disagree]. The validity and reliability studies of the scale were conducted as a pilot application to 451 undergraduate students and graduates. The validity and reliability results of the scale were tested and approved by using confirmatory factor analysis with the data obtained from the application to 1287 participants. Cronbach Alpha coefficients of the sub-dimensions of the scale; Ethics and Responsibility were calculated as α= ,84, General Knowledge and Functional Skills α= ,87, Daily Use α= ,78, Professional Production α= ,71, Privacy and Security α= ,82, and Social Dimension α= ,86. In this study, Ethics and Responsibility were calculated as α= ,76, General Knowledge and Functional Skills α= ,54, Daily Use α= ,82, Professional Production α= ,73, Privacy and Security α= ,66, and Social Dimension α= ,73.

2.4. Data Analysis

The data of the study were analyzed using the SPSS 28.0 software package for statistical analysis. Arithmetic mean, frequency, percentage, t-test, one-way analysis of variance (ANOVA) were used to analyze the data.

3. RESULTS

The findings of this study, which was conducted to examine the digital literacy levels of undergraduate students, are presented in terms of gender, faculty type and daily internet time variables.

The descriptive analysis table of the undergraduate students' Digital Literacy Scale sub-dimensions is presented in Table 2.

Table 2. Descriptive statistics of Digital Literacy Scale sub-dimension scores

Digital literacy Sub-Dimensions	N	Minimum	Maximum	$\bar{X}$	Standard Deviation
Ethics and Responsibility	386	7.00	73.00	28.97	5.76
General Knowledge and Functional Skills	386	6.00	86.00	18.93	6.80
Daily Use	385	6.00	36.00	24.54	4.71
Professional Production	386	2.00	10.00	4.70	2.10
Privacy and Security	386	4.00	46.00	17.02	3.45
Social Dimension	386	4.00	20.00	13.23	3.65

When the Digital Literacy Scale sub-dimensions are examined, the Ethics and Responsibility sub-dimension has the highest average, while the lowest average is in the Professional Production sub-dimension. The reason why the lowest average was in the Professional Production sub-dimension could as the lack of faculties with computer or software knowledge among the participants. When the averages of the other sub-dimensions are examined, they are listed as Daily Use, General Knowledge and Functional Skills, Privacy and Security, and Social Dimension.

A t-test was conducted to determine whether there was a significant difference in the digital literacy levels of undergraduate students between male and female students. The findings are presented in Table 3.

Table 3. T-test results of undergraduate students' Digital Literacy Scale sub-dimension scores by gender

Digital literacy Sub-Dimensions	Gender	N	X	ss.	t test		
					t	sd	p
Ethics and Responsibility	Male	111	27.6486	6.47604	-2.874	383	**,004**
	Female	274	29.4964	5.37682	-2.658	174.531	**,009**
General Knowledge and Functional Skills	Male	111	20.8304	6.11141	3.528	384	**,000**
	Female	274	18.1752	6.93866	3.721	232.541	**,000**
Daily Use	Male	110	23.7455	5.67375	-2.214	382	**,027**
	Female	274	24.9088	4.18033	-1.949	158.677	,053
Professional Production	Male	111	5.1982	2.33480	2.887	383	**,004**
	Female	274	4.5219	1.97082	2.688	176.734	**,008**
Privacy and Security	Male	111	16.9369	4.60884	-,302	383	,763
	Female	274	17.0547	2.87861	-,250	146.045	,803
Social Dimension	Male	112	13.4107	3.99223	,532	383	,595
	Female	273	13.1941	3.46978	,502	183.276	,617

*p <0.01 and *p < 0.05

In table 3, t-test results on the sub-scales of the Digital Literacy Scale according to the gender of the students are seen. As a result of the study, a significant difference was found in the sub-dimension of Ethics and Responsibility in favour of female students. On the other hand, a significant difference was found in the sub-dimension of Daily Use, General Knowledge and Functional Skills, and Professional Production in favour of male students. No statistically significant difference was achieved between the Privacy and Security and Social Dimension sub-scales of the Digital Literacy Scale and the gender of students.

One-Way Analysis of Variance (ANOVA) Test was conducted to determine whether there was a significant difference in the Digital Literacy Scale sub-dimension scores of students according to the type of faculty. The findings are presented in Table 4.

One-way analysis of variance was administrated to determine whether there was a significant difference between the type of faculty of students and digital literacy scale sub-dimensions scores. As seen in Table 4, the digital literacy scale sub-dimensions scores showed a significant difference according to the type of faculty of students. The analysis results suggested that there was a statistically significant difference among the Digital Literacy Scale sub-dimensions of Daily Use ($F_{2;381}= 4.812$, $p<0.05$), Professional Production ($F_{2;382}=3.475$, $p<0.05$), and Privacy and Security ($F_{2;382}=10.316$, $p<0.05$) with the type of faculty. Scheffe test was used to determine between which groups the differentiation occurred. According to the Scheffe test results, there is a significant difference between the Faculty of Economics and Administrative Sciences ($\bar{x}= 25.53$) and the Faculty of Health Sciences ($\bar{x}= 23.56$) in the Daily Use sub-dimension, the Faculty of Education ($\bar{x}= 4.41$) and

Faculty of Health Sciences ($\bar{x}$= 5.03), in the Professional Production sub-dimension, and the students of the Faculty of Education and Health Sciences and the students of the Faculty of Economics and Administrative Sciences in the Privacy and Security sub-dimension. No significant difference was found according to the other sub-dimension levels.

Table 4. ANOVA test analysis results of undergraduate students' scores of digital literacy sub-dimensions according to faculties

		Sum of Squares	Sd	Mean Square	F	p	Significance
Ethics and responsibility	Between groups	127.070	2	63.535			
	Within groups	12648.421	382	33.111	1.919	,148	
	Total	12775.491	384				
General knowledge and functional skills	Between groups	251.188	2	125.594			
	Within groups	17598.669	383	45.950	2.733	,66	
	Total	17849.858	385				
Daily use	Between groups	206.598	2	103.299			
	Within groups	8179.212	381	21.468	4.812	**,009**	3>2
	Total	8385.810	383				
Professional production	Between groups	30.310	2	15.155			
	Within groups	1665.831	382	4.361	3.475	**,032**	1>2
	Total	1696.140	384				
Privacy and security	Between groups	235.708	2	117.854			
	Within groups	43644.126	382	11.424	10.316	**,000**	1,2>3
	Total	4599.834	384				
Social dimension	Between groups	62.142	2	31.070			
	Within groups	4985.401	382	13.051	2.381	0.094	
	Total	5047.543	384				

1-Faculty of Education 2- Faculty of Health Sciences 3-Faculty of Economics and Administrative Sciences

One-Way Analysis of Variance (ANOVA) Test was conducted to determine whether there is a significant difference between undergraduate students' digital literacy scale sub-dimension scores according to their daily internet usage times. The findings are presented in Table 5.

According to Table 5, a significant difference was found between the general knowledge and functional skills sub-dimension of the digital literacy scale scores (F3;380) = 3,293, p<0,05) of the students participating in the research according to their daily internet usage times. According to the results of the Scheffe test, which was conducted to determine between which groups the differentiation is, this difference is between the students who use the internet for 10 hours or more daily ($\bar{x}$= 22.34) and the students who use the internet for 6-9 hours ($\bar{x}$= 18.42) and 3-5 hours ($\bar{x}$= 18.70). No significant difference was found according to the other sub-dimension levels.

Table 5. ANOVA test analysis results according to the digital literacy scale sub-dimensions scores of undergraduate students and their daily internet usage time

		Sum of Squares	Sd	Mean Square	F	p	Significance
Ethics and responsibility	Between groups	178.847	3	59.616			
	Within groups	12533.059	380	32.982	1.808	,142	
	Total	12711.906	383				
General knowledge and functional skills	Between groups	451.119	3	150.373			
	Within groups	17398.736	381	21.850	3.293	**,021**	D>C,B
	Total	17849.855	384				
Daily use	Between groups	47.058	3	15.686			
	Within groups	8281.213	379	21.850	,718	,542	
	Total	8328.272	382				
Professional production	Between groups	7.061	3	2.354			
	Within groups	1688.564	380	4.444	,530	,662	
	Total	1695.625	383				
Privacy and security	Between groups	11.015	3	3.672			
	Within groups	4539.399	380	11.946	,307	,820	
	Total	4550.414	383				
Social dimension	Between groups	15.879	3	5.293			
	Within groups	5003.954	380	13.168	,402	,752	
	Total	5019.833	383				

1-2 hour(s). B- 3-5 hours. C-6-9 hours D-10 hours and more

4. DISCUSSION AND CONCLUSIONS

In this study, it was aimed to examine the digital literacy levels of undergraduate students in terms of different variables. According to the study's findings, when the students' average scores in the digital literacy scale sub-dimensions are examined, the average digital literacy score total of the participants is 107.39. The arithmetic mean score of the scale, which is formed by dividing by the number of items in the scale (n=29), is 3.70. Bayrakcı and Narmanlıoğlu (2020) stated that the range of 3.63-4.17 points in the scale study he developed within the scope of his doctoral thesis is medium level. In this context, it is seen that the students participating in the research are digitally literate at a reasonable level. In other words, the students participating in the research seem to continue to adapt and learn in the digital age. At the same time, they are generally at a level that can solve non-continuous, relatively easy problems on their own (Bayrakcı, & Narmanlıoğlu, 2020). This finding can be explained by the commitment of the Z generation to online environments, their communication habits through social media channels, and the high level of digital literacy as a result of students' spending more time on digital technology during the COVID-19 pandemic process. In the literature, it is seen that both the same and different results were obtained with this study (Lokmic-Tomkins et al., 2022; Morgan et al., 2022; Onursoy, 2018). For example, Göldağ (2021) examined the digital literacy skills of university students in his study. A digital literacy scale was applied to 265 students in the study. As a result of the study, it was concluded that the digital literacy levels of the students were moderate. In other studies, the digital literacy skills of undergraduate students were found to be high and low. For instance,

Adeoye, and Adeoye (2017) examined the digital literacy skills of undergraduate students in Nigeria in their study. In the study, they applied a demographic information form and digital literacy scale to 525 students. As a result of the study, they concluded that the students' digital literacy levels are high. The results of the "Digital Literacy Scale" that Bayrakcı and Narmanlıoğlu (2021b) administered to 1287 undergraduate students and graduates showed that the participants had high digital literacy skills. In other studies, the digital literacy skills of undergraduate students were found to be medium and low (Göldağ, 2021; Lokmic-Tomkins et al., 2022; Morgan et al., 2022; Onursoy, 2018).

As a result of the research, according to the gender variable; Ethics and Responsibility, General Knowledge and Functional Skills, Daily Use, and Professional Production sub-dimensions were found to differ significantly by gender. Accordingly, it was concluded that the average of female students in the Ethics and Responsibility sub-dimension was higher than male students. It is seen that this result of the research is compatible with the study of Kul (2020). There was a significant difference in favour of male students in General Knowledge and Functional Skills and Professional Production sub-dimensions. In some studies, in the literature, it has been observed that the digital literacy levels of male students are higher than female students (Bayrakcı & Narmanlıoğlu, 2021b; Boyacı, 2019; Çetin, 2016; Göldağ, 2021; Güngör & Kurtipek, 2020; Hardy, 2005; Horne, 2007; İnan Karagül et al., 2021; Korkmaz, 2020; Markauskaite, 2006; Özerbaş & Kuralbayeva, 2018; Özoğlu, 2019; Yazıcıoğlu et al., 2020; Yeşildal, & Kaya, 2021; Zogheib, 2006). In other studies, it was found that gender was not effective in digital literacy (Karasu, & Arıkan, 2016; Maden, Maden, & Banaz, 2018).

According to the faculties of the students participating in the research, a significant difference was found between Daily Use, Professional Production, and Privacy and Security, which are sub-dimensions of digital literacy scale scores. These differences are between, In the Daily Use sub-dimension, the students of the Faculty of Economics and Administrative Sciences ($\bar{x}$= 25.53) and the students of the Faculty of Health Sciences ($\bar{x}$= 23.56). In other words, the students of the Faculty of Economics and Administrative Sciences have a higher ability to such as use e-citizenship, cloud technologies, online broadcasting, and digital transactions than the students of the Faculty of Health Sciences. This finding of the study seems to be compatible with the study of Morgan et al. (2022). In the Professional Production sub-dimension, a significant difference was found between the students of the Faculty of Education ($\bar{x}$= 4.41) and the students of the Faculty of Health Sciences ($\bar{x}$= 5.03). In other words, such as the software and coding digital skills of the students of the Faculty of Education are higher than the students of the Faculty of Health Sciences. The result of the study was found to be compatible with other studies (Timur et al., 2014; Yazıcıoğlu et al., 2020). In the privacy and security sub-dimension, there is a significant difference between the students of the Faculty of Education and the students of the Faculty of Health Sciences, and the students of the Faculty of Economics and Administrative Sciences. In other words, the students of the Faculty of Education and the Faculty of Health Sciences have a higher ability to such as protect personal data, avoid phishing, set privacy, and create strong passwords than the students of the Faculty of Economics and Administrative Sciences. It is seen that this

result of the research is compatible with other studies in the literature (Garcia-Martin, & Garcia-Sanchez,2017; Kozan & Bulut Özek, 2019; Özden, 2018; Yılmaz et al.,2019).

As a result of the research, according to the daily internet usage time variable, a significant difference was found between the general knowledge and functional skills sub-dimension of the digital literacy scale scores of the students. This difference is between the students who use the internet daily for 10 hours or more ($\bar{x}$= 22.34), and the students who use the internet for 6-9 hours ($\bar{x}$= 18.42) and 3-5 hours ($\bar{x}$= 18.70). It is seen that the result of the research is compatible with the study of Göldağ (2021).

Recommendations

- Training can be given to university students on the use of digital tools in their professional life.
- Workshops can be organized for students to improve themselves in all dimensions of digital literacy and to increase their digital literacy levels.
- In addition, studies can be planned for the development of students by determining their technological education needs.
- A comparison study can be made with the students of other faculties.
- In addition to existing courses such as information technologies in undergraduate education of students, it is recommended that courses such as digital literacy and digital technologies can be opened in all universities as soon as possible.

REFERENCES

Acar, C. Y (2015). *Views of parents on their digital literacy with their primary, secondary and high school students*. Unpublished Master Thesis. Ankara University, Institute of Educational Sciences.

Adeoye, A.A., & Adeoye, B.J. (2017). Digital literacy skills of undergraduate students in Nigeria universities. Unpublished Master Thesis. Retrieved from: https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=4736&context=libphilprac

Ahmed, S. T., & Roche, T. (2021). Making the connection: Examining the relationship between undergraduate students' digital literacy and academic success in an English medium instruction (EMI) university. *Education and Information Technologies*, 26(4), 4601-4620. https://doi.org/10.1007/s10639-021-10443-0

Bayrakcı, S. & Narmanlıoğlu, H. (2021a). Digital literacy as whole of digital competences: Scale development study*. Thought and Society Journal of Social Sciences, 4,*1-30. https://dergipark.org.tr/en/download/article-file/1797036

Bayrakcı, S. & Narmanlıoğlu, H. (2021a). Investigation of digital literacy levels of undergraduate students and graduates in Turkey. *AJIT-e: Online Journal of Information Technologies, 12*(46), 46-67. https://dergipark.org.tr/en/pub/ajit-e/issue/64682/954349

Bayrakcı, S., & Narmanlıoğlu, H. (2020). Dijital yetkinlikler bütünü olarak dijital okuryazarlık: Ölçek geliştirme çalışması*. Doktora Tezi, Sosyal Bilimler Enstitüsü,* Marmara Üniversitesi, İstanbul. Retrieved: https://tez.yok.gov.tr/UlusalTezMerkezi/tezDetay.jsp?id=prmQl-2va54pZw--BraA_w&no=N20qjRJkP1tSLLp-FVZs8w

Yoleri, S., Anadolu, Z.N.(2022). Examination of digital literacy skills of undergraduate students according to various. *Advanced Education*, 21, 121-134. DOI: 10.20535/2410-8286.262190

Benson, V. & Kolsaker, A. (2015). Instructor approaches to blended management learning: A tale of two business schools. *The International Journal of Management Education*, *13*(3), 316-325. https://doi.org/10.1016/j.ijme.2015.10.001

Boyacı, Z. (2019). *The relationship between prospective teachers' lifelong learning tendencies and their digital literacy levels: The case of Düzce University*. Master's thesis, Sakarya University. https://acikerisim.sakarya.edu.tr/handle/20.500.12619/74532

Council of Higher Education, CHE. (2019). 'Digital Literacy' Course for 30 thousand Students in Universities was accessed from https://basin.yok.gov.tr/InternetHaberleriBelgeleri/İnternet%20Haber%20Belgeleri/2019/113_univ_dijital_okuryazarlik_dersi.pdf on 08.07.2022.

Çetin, O. (2016). Examination of numerical literacy levels of undergraduate science teacher candidates with pedagogical formation program*. Erzincan University Journal of Education Faculty, 18*(2), 658-685. https://doi.org/10.17556/jef.01175

Direkçi, B., Akbulut, S., & Şimşek, B. (2019). Examination of Turkish lesson curriculum (2018) and secondary school Turkish textbooks in the context of digital literacy skills. *Eurasian Journal of International Studies, 7*(16), 797-813. https://doi.org/10.33692/avrasyad.543868

Eshet-Alkalai, Y. (2004). Digital literacy: A conceptual framework for survival skills in the digital era. *Journal of Educational Multimedia and Hypermedia,* 93-106. https://psycnet.apa.org/record/2004-13959-005

European Union (2021). *The Digital Education Action Plan 2021-2027.* Retrieved from: https://ec.europa.eu/education/education-in-the-eu/digital-education-action-plan_en/ September, 2022.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (8th Edition). New York: The McGraw-Hill Company.

Furman, R, L. (2015). Technology, reading and digital literacy: Strategies to engage the reluctant reader. International Society for Technology in Education. Eugene, Oregon-Arlington, VA.

Garcia-Martin, J., & Garcia-Sanchez, J. N. (2017). Pre-service teachers' perceptions of the competence dimensions of digital literacy and of psychological and educational measures*. Computers & Education*, 107, 54-67. https://doi.org/10.1016/j.compedu.2016.12.010

Gilster, P. (1997). *Digital Literacy. New York: Wiley Computer Pub.*

Göldağ, B. (2021). Examining the relationship between university students' digital literacy levels and digital data security awareness levels, E-International *Journal of Educational Research, 12(*3), 82-100. https://doi.org/10.19160/e-ijer.950635

Güngör, N. B., & Kurtipek, S. (2020). Investigation of the effect of individual innovativeness level of sports science faculty students on digital literacy with structural equation model. *Journal of Human Sciences, 17*(2), 756-767. https://doi.org/10.14687/jhs.v17i2.6021.

Hamutoğlu, N. B., Gungoren, O. C., Uyanık, G. K. & Erdogan, D. G. (2017). Digital Literacy Scale: Adaptation study into Turkish. *Aegean Journal of Education, 18*(1), 408-429. https://doi.org/10.12984/egeefd.295306

Hardy, C. A. (2005). *A Study of Midwest Students' Technology Skills.* Unpublished PhD Thesis. University of Nebraska.

Horne, J. (2007). Gender differences in computerized and conventional educational tests. *Journal of Computer Assisted Learning, 23*(1), 47-55. https://doi.org/10.1111/j.1365-2729.2007.00198.x

İnan Karagül, B., Şeker, M., & Aykut, C. (2021). An investigation of students' digital literacy levels during online education due to the COVID-19 Pandemic. *Sustainability, 13* (21) 11878. https://doi.org/10.3390/su132111878

Karasar, N. (2006). *Scientific Research Methods*. Ankara: Nobel Spring.

Karasu, M., & Arikan, D. (2016). Examination of the relationship between pre-service teachers' social media usage status and media literacy levels. *Aegean Journal of Education, 17*(2), 549-566. https://doi.org/10.12984/egeefd.280757

Korkmaz, M. (2020). *Determination of digital literacy levels of classroom teachers.* Master's thesis, ESOGÜ.

Kozan, M., & Bulut Özek, M. (2019). CEIT department teacher candidates Examination of digital literacy levels and sensitivities regarding cyberbullying. *Fırat University Journal of Social Sciences, 29*(1), 107-120. https://doi.org/10.18069/firatsbed.538657

Kul, S. (2020). Examining the relationship between digital literacy and other variables and internet addiction. International *Journal of Management Information Systems and Computer Science, 4*(1), 28-41. https://doi.org/10.33461/uybisbbd.646682

Lokmic-Tomkins, Z., Choo, D., Foley, P., Dix, S., Wong, P., & Brand, G. (2022). Pre-registration nursing students' perceptions of their baseline digital literacy and what it means for education: A prospective COHORT survey study. *Nurse Education Today*, *111.* https://doi.org/10.1016/j.nedt.2022.105308.

Maden, S., Maden, A., & Banaz, E. (2018). The evaluation of 5th grade Turkish course books within the context of digital literacy. *The Journal of International Social Research, 11*(55), 1-14. https://doi.org/10.17719/jisr.20185537239

Markauskaite, L. (2006). Gender issues in preservice teachers' training: ICT literacy and online learning. *Australasian Journal of Educational Technology*, *22*(1). https://doi.org/10.14742/ajet.1304

McDougall, J., Readman, M., & Wilkinson, P. (2018). The uses of (digital) literacy. *Learning, Media and Technology*, *43*(3), 263-279. https://doi.org/10.1080/17439884.2018.1462206

Ministry of National Education, MEB. (2018). Secondary school mathematics course (9th, 10th, 11th and 12th grades) curriculum. Ankara: Board of Education and Discipline. Retrieved from http://mufredat.meb.gov.tr/ProgramDetay.aspx?PID=343 on 10.07.2022.

Morgan, A., Sibson, R., & Jackson, D. (2022). Digital demand and digital deficit: conceptualizing digital literacy and gauging proficiency among higher education students. *Journal of Higher Education Policy and Management, 44*(3), 258-275. https://doi.org/10.1080/1360080X.2022.2030275

Ng, W. (2012). Can we teach digital natives' digital literacy? *Computers & Education, 59*, 1065-1078. https://doi.org/10.1016/j.compedu.2012.04.016

Onursoy, S. (2018). Digital literacy levels of university youth: A study on Anadolu University students. Gümüşhane University *Faculty of Communication Electronic Journal, 6*(2), 989-1013. https://doi.org/10.19145/e-gifder.422671

Özden, M. (2018). Digital Literacy Perceptions of the Students in the Department of Computer Technologies Teaching and Turkish Language Teaching. *International Journal of Progressive Education, 14*(4), 26-36. https://doi.org/10.29329/ijpe.2018.154.3

Özerbaş, M. A., & Kuralbayeva, A. (2018). Evaluation of digital literacy levels of Turkish and Kazakhstan teacher candidates. *Journal of Muğla Sıtkı Koçman University Faculty of Education, 5*(1), 16-25. https://doi.org/10.21666/muefd.314761

Özoğlu, C. (2019). *The relationship between prospective teachers' lifelong learning tendencies and their digital literacy (Anadolu University Faculty of Education example).* Master's thesis, Institute of Educational Sciences.

Partnership for 21st Century Skills. (2019). Framework for 21st Century Learning. Retrieved on 19.07.2022 from http://www.p21.org/storage/documents/docs/P21_.

Timur, B., Timur, S. & Akkoyunlu, B. (2014). Determining the numerical competence levels of teacher candidates. Muğla University *Journal of Social Sciences Institute, 33,* 41-59. https://dergipark.org.tr/tr/pub/musbed/issue/23267/248345

Law, N., Woo, D., de la Torre, J. and Wong, G. (2018). A global framework of reference on digital literacy for indicator 4.4.2. *Information Paper 51.* UNESCO Institute for Statistics. Retrieved June, 2020 from https://uis.unesco.org/sites/default/files/documents/ip51-global-framework-reference-digital-literacy-skills-2018-en.pdf

Yoleri, S., Anadolu, Z.N.(2022). Examination of digital literacy skills of undergraduate students according to various. *Advanced Education*, 21, 121-134. DOI: 10.20535/2410-8286.262190

UNICEF. (2017). State of the world's children 2017: Children in a digital world. Retrieved from https://www.unicef.org/turkiye/media/4291/file/World%20Children's%20Durumu%202017:%20Dijital%20bir%20dunyada%20Children.pdf

Yazıcıoğlu, A., Yaylak, E., & Genç, G. (2020). Digital literacy levels of pre-school and primary school teacher candidates. *ODU Journal of Social Sciences Research, 10*(2). https://dergipark.org.tr/en/pub/odusobiad/issue/56076/686913

Yeşildal, M. & Kaya, Ş. D. (2021). Yetişkin bireylerde dijital okuryazarlık ve sağlık okuryazarlığı arasındaki ilişki: KONYA örneği. *Sağlık Bilimleri Dergisi, 30*(2), 174-181. DOI: 10.34108/eujhs.774808

Yılmaz, A., Kaya, M., Akca, N., & Sönmez, S. (2019). *Investigation of digital literacy levels of health sciences faculty students*. 3rd International 13 National Congress on Health and Hospital Administration, Sakarya. Proceedings Book (pp. 287-297). Retrieved from: https://www.researchgate.net/publication/339209308_SAGLIK_BILIMLERI_FAKULTESI_OGRENCILERININ_DIJITAL_OKURYAZARLIK_DUZEYLERININ_INCELENMESI

Zogheib, S. (2006). *Explaining computer use among preservice teachers: Towards the development of a richer conceptual model incorporating experience, demographic, motivation, personality, and learning style clusters of variables.* Unpublished Thesis. University of Windsor. Retrieved from: https://scholar.uwindsor.ca/cgi/viewcontent.cgi?article=3032&context=etd

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