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Examining The Relationship Between Preservice Physical Education and Sports Teachers' Digital Literacy Levels and Artificial Intelligence Anxiety

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Abstract

The aim of the study is to examine the relationship between the digital literacy (DL) levels of pre-service physical education and sports teachers and their artificial intelligence anxieties (AIA). A total of 362 pre-service physical education and sports teachers, studying in the 2024-2025 academic year, participated in the research which is conducted using the relational screening model, one of the quantitative research methods. The data were collected using the Digital Literacy scale (DLS), the Artificial Intelligence Anxiety scale (AIAS), and the Personal Information Form. The data obtained in the study were analyzed using SPSS 27 with skewness-kurtosis analysis, independent samples t-test, one-way ANOVA and Pearson correlation analysis tests. The findings showed that there was no significant difference in digital literacy levels in terms of gender, but female participants had higher anxiety levels in the "AI configuration" sub-dimension. It was determined that the digital literacy levels of third-grade students were significantly higher than those of other grades. While the digital literacy levels of the participants living in the city were found to be higher, this variable did not create a significant difference in AI anxiety. The participants' DLs were high, their DL was at a medium level, and a negative, weak significant relationship was found between DL and AIA. As a result, it can be said that developing digital literacy can be effective in reducing AI anxiety.

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Beden Eğitimi ve Spor Öğretmeni Adaylarının Dijital Okuryazarlık Seviyeleri İle Yapay Zekâ Kaygıları Arasındaki İlişkinin İncelenmesi

Öz

Çalışmanın amacı beden eğitimi ve spor öğretmeni adaylarının dijital okuryazarlık seviyeleri ile yapay zeka kaygıları arasındaki ilişkinin incelenmesidir. Nicel araştırma yöntemlerinden ilişkisel tarama modelinde yapılan araştırmaya 2024-2025 akademik yılında öğrenim gören toplam 362 beden eğitimi ve spor öğretmeni adayı katılmıştır. Veriler Üstündağ vd. (2017) Türkçeye uyarladığı Dijital Okuryazarlık ölçeği (DOÖ), Akkaya vd. (2021) Türkçeye uyarladığı Yapay Zekâ Kaygısı ölçeği (YZKÖ) ve Kişisel Bilgi Formu kullanılarak toplanmıştır. Araştırmada elde edilen veriler SPSS 27 kullanılarak çarpıklık-basıklık analizi, bağımsız örneklemler t-testi, one-way ANOVA ve pearson korelasyon analizi testleri ile analiz edilmiştir. Bulgular; dijital okuryazarlık düzeylerinde cinsiyet açısından anlamlı bir fark bulunmadığını, ancak kadın katılımcıların "YZ yapılandırması" alt boyutunda daha yüksek kaygı seviyesine sahip olduğunu göstermiştir. Üçüncü sınıf öğrencilerinin dijital okuryazarlık düzeylerinin diğer sınıflara göre anlamlı şekilde yüksek olduğu tespit edilmiştir. Şehirde yaşayan katılımcıların dijital okuryazarlık düzeyleri daha yüksek bulunurken, bu değişken YZ kaygısında anlamlı fark oluşturmamıştır. Katılımcıların DO'larının yüksek, YZK'nın orta seviyede olduğu, DO ile YZK arasında negatif, zayıf kuvvetli anlamlı ilişki tespit edilmiştir. Sonuç olarak, dijital okuryazarlığın geliştirilmesinin YZ kaygısını azaltmada etkili olabileceğini gösterdiği söylenebilir.

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INTRODUCTION

Artificial intelligence (AI) has become widely integrated into today's society, touching diverse fields by making contributions. According to Yılmaz (2022), AI simulates human behaviour by modeling its cognitive duty through digital systems. Similarly, Krauss (2024) defines AI as smart machines exhibiting intelligent tasks, which require human intelligence, including problem-solving and decision-making. AI has benefits for many areas such as healthcare (early disease diagnosis etc.), finance (fraud detection etc.), transportation (autonomous logistic systems etc.), agriculture (smart irrigation systems etc.), and education (personalized learning etc.). Specifically in education, there can be seen many examples about AI; personalized learning environments, by analyzing students' learning styles and pace (Ayeni et al., 2024), automated assessments, instant feedback and customized evaluations (Maghsudi et al., 2021; Murtaza et al., 2022; Pataranutaporn et al., 2021). With such a wide use of AI, AI-supported learning models offer opportunities for collaboration with students and educators by supporting learning (Ouyang and Jiao, 2021). Teachers who view AI as a tool for reducing workload and supporting professional development are progressing toward becoming "leading teachers" in line with contemporary educational demands (Çoban & Gün, 2024).

AI's influence reach beyond traditional classroom settings into practical areas such as physical education and sports (PE). The use of AI technologies in PE classes can also play an important role in individual performance analysis, feedback processes (Casey et al., 2017; Kirkwood and Price, 2014), movement analysis, virtual training programs, digital feedback systems etc. (Özen et al., 2016). For example, Hsia et al. (2023) reported improved yoga performances through AI-based automated feedback. Claudino et al. (2019) also reported AI's effective usage in predicting injury risks and performance. Guo and Li (2021) stated that AI tools can be used in parts such as energy consumption, step counting, instant heart rate monitoring, and physical fitness calculations. Sun and Zheng (2021) concluded that AI-supported courses for basketball significantly increased teaching quality. Papastergiou et al. (2021) reported that child-friendly fitness apps in PE classes increased student participation and supported teachers more time for individualized feedback by easing their workloads. When evaluated briefly, these examples illustrate AI's potential to support skill development, physical fitness, objective evaluation, and personalized feedback in PE settings.

Although, the idea that AI will increase excessively within society and become an invasive entity in many areas does not seem realistic, with today's rapid developments, adapting to this new process can be perceived as a painful process as a result of some misunderstandings (Akkaya et al., 2021). Concerns regarding the potential uncontrollability or excessive intrusiveness of AI technologies may give rise to Artificial Intelligence Anxiety (AIA), defined by feelings of fear, apprehension, or unease toward the use and implications of AI technologies (Johnson and Verdicchio, 2017; Şen, 2024). These concerns are thought to stem from uncertainties regarding AI's future role in education and potential job security issues like what its effects will be, and how teachers will adopt and adapt to this technology (Wang and Siau, 2019; Wang and Wang, 2022). How AI will be used in PE classes, which is dependent on mobility, and how PE teachers adapt to these changes even cause preservice PE teachers to feel anxious.

In response to such challenges, digital literacy (DL) has emerged as an essential competency for educators about determining what, how, when, for what purpose to teach and how to evaluate (Erwin and Mohammed, 2022). According to Aviram and Eshet-Alkalai (2006), DL encompasses a blend of technical, cognitive, emotional, and social abilities. In other words, DL includes the ability to use technological equipment as required, scan digital resources, classify the obtained data, make sense of it, and evaluate its accuracy (Direkçi et al., 2019; Ng, 2012). Walters et al. (2019) associate DL not only with understanding the functionality of technology but also with applying knowledge and skills through technology across various contexts. In education, DL enables educators to incorporate diverse educational technologies—such as learning management systems, virtual reality, interactive apps, and multimedia resources—into their teaching to enhance instructional quality and student engagement (Casey et al., 2017; Holm, 2024; Mishra and Koehler, 2006). Being digitally literate not only helps teachers adapt to technological developments but also enables them to integrate innovations into their curriculum (Erwin and Mohammed, 2022).

Within PE specifically, DL is critical for effectively managing digital tools and online educational settings, encompassing cognitive, motor, and social dimensions (Wicaksono-Ikhsan and Suherman-Wawan, 2023). Digitally literate PE teachers can use fitness applications, augmented reality, video analysis software, and gamified platforms to deepen students' understanding, improve motivation, and enhance cognitive involvement in physical activities (Marín-Suelves et al., 2023; Østerlie et al., 2022). As future implementers of these tools, preservice PE teachers' artificial intelligence anxiety and digital literacy status are notably important. Digital literacy levels of them play an important role in how they will implement or use artificial intelligence tools in their classrooms in the future (Asio and Suero, 2024; Falebita, 2024). Therefore, high level of digital literacy may help reduce anxieties about AI, enhancing their readiness and adaptability to new technological tools (Ng et al., 2021). Long and Magerko (2020) similarly stated that digital literacy helps educators use artificial intelligence applications responsibly, and at the same time, they stated that while limited digital literacy can lead to misunderstandings about artificial intelligence technologies, an increase in this situation can have the opposite effect and help reduce anxiety. In this context, when the literature is examined, it is also noteworthy that there is no study with pre-service PE teachers on the concepts of AIA, DL and the relationship between them. Addressing this gap, the present study aims to explore this, offering insights to better prepare future educators.

METHOD

Research Model

The research was designed in relational screening model. The relational screening model is "one of the quantitative research methods that aims to determine whether there is a relationship between at least two variables, if any, to determine its degree and to obtain clues about the reason" (Büyüköztürk et al., 2020; Karasar, 2011).

Population-Sample (Research Group)

The population of the research consisted of all students studying at Karabük University, Hasan Doğan Faculty of Sports Sciences in the 2024-2025 Academic Year, and in the process of determining the sample group, the criterion sampling method, one of the purposeful sampling methods, was used. It is a sampling selection method based on a specific criterion (Baltacı, 2018). The criterion set for participation in the study was being either a student in physical education and sports teaching program or a student from coaching education/sports management departments enrolled in pedagogical formation training to become a teacher. Accordingly, 362 pre-service physical education and sports teachers participated in the study voluntarily.

Data Collection Tools

Personal Information Form

Personal Information Form, which was created by the researchers, has questions about participants' demographic characteristics such as their genders, family incomes etc.

Digital Literacy Scale

The "Digital Literacy scale", was developed by Ng (2012) and adapted to Turkish by Üstündağ et al. (2017), with 10 items and a single dimension. The Cronbach Alpha reliability coefficient was stated as .86 in its original form, and it was calculated as .91 for this study. The scale has items such as *"I can learn new technologies easily", "I know how to solve my own technical problems".* Confirmatory factor analysis results of the scale is given in Table 1.

Table 1. Confirmatory factor analysis of digital literacy scale

Index	Good Fit	Acceptable	Digital Literacy Scale
X^2 /df	<3	<3(X^2 /df)<5	2,5
GFI	>,95	>,90	,96
CFI	>,95	>,90	,98
RMSEA	<,05	<,08	,06
SRMR	<,05	<,08	,03

As seen in table 1, it is observed that X^2/df (2.5); the CFI (.98), GFI (.96) and SRMR (.03) values are at good fit; RMSEA (.06) value is at an acceptable level (Byrne, 2016; Gürbüz, 2021; Jöreskog and Sörbom, 1993; Kline 2016; Meyers et al., 2006).

Artificial Intelligence Anxiety Scale

The "Artificial Intelligence Anxiety Scale" (AIA) was developed by Wang and Wang (2019) and adapted to Turkish by Akkaya et al. (2021), with 16 items and 4 sub-dimensions. The Cronbach Alpha reliability coefficient was .93. It was calculated as .94 for this study. The AIA scale includes four basic dimensions "*learning, job change, sociotechnical blindness*, and *artificial intelligence configuration"*. The *learning* sub-dimension explains individuals' anxiety about learning artificial intelligence technology, the *job change* sub-dimension explains the anxiety that artificial intelligence will negatively affect business life, the *sociotechnical blindness* sub-dimension explains the anxiety experienced due to not fully understanding the dependency of artificial intelligence on humans, and the *artificial*

intelligence configuration sub-dimension explains students' anxiety about human-like artificial intelligence (Wang and Wang, 2019). The scale has items such as *"Learning to use artificial intelligence techniques/products makes me anxious", "I find humanoid AI techniques/products (e.g. humanoid robots) intimidating".* Confirmatory factor analysis results of the scale is given in Table 2.

Table 2. Confirmatory factor analysis of artificial intelligence anxiety scale

Index	Good Fit	Acceptable	Artificial Intelligence Anxiety Scale
X^2 /df	<3	<3(X^2 /df)<5	2,7
GFI	>,95	>,90	,91
CFI	>,95	>,90	,96
RMSEA	<,05	<,08	,06
SRMR	<,05	<,08	,04

As seen in table 2, it is observed that X^2/df (2.7); the CFI (.96) and SRMR (.04) values are at good fit; GFI (.91) and RMSEA (.06) values are at an acceptable level (Byrne, 2016; Gürbüz, 2021; Jöreskog and Sörbom, 1993; Kline 2016; Meyers et al., 2006).

Data Collection Process

The data were collected in a classroom environment after the necessary information was given to the students. Before starting the research, approval was obtained from the Karabük University, Social and Human Sciences Research Ethics Board (Date: 27.09.2024, Meeting No: 2024/08).

Data Analysis

Normality tests were first performed with SPSS 27. All related skewness and kurtosis values were examined, and all was seen as between -1 and +1. The data showed a normal distribution when these values are between -1 and +1 (Gürbüz and Şahin, 2016; Tabachnick and Fidell, 2013). The data were assumed to have a normal distribution so independent groups t-test, one-way analysis of variance (ANOVA) and Pearson correlation coefficient were used. The source of the significant difference obtained as a result of one-way analysis of variance (ANOVA) was determined with LSD in post-hoc methods and the significant difference level for all statistical analyses was accepted as p<.05.

FINDINGS

Table 3. Demographic Information of Participants

		n	%
Gender	Female	130	35,9
	Male	232	64,1
	Total	362	100,0
Grade	1. Grade	83	22,9
	2. Grade	72	19,9
	3. Grade	72	19,9
	4. Grade	135	37,3
	Total	362	100,0
Family Income	Income less than expenses	49	13,5
	Income equal to expenses	185	51,1

	Income more than expenses	128	35,4
	Total	362	100,0
The Place with the Longest Lifespan	Province	196	54,1
	District	136	37,6
	Village	30	8,3
	Total	362	100,0

According to Table 3, of the 362 participants, 130 (35.9%) were female and 232 (64.1%) were male. The participants were distributed as 83 (22.9%) first-year students, 72 (19.9.5%) second-year students, 72 (19.9%) third-year students, and 135 (37.3%) fourth-year students. Family income status was stated as 49 (13.5%) students as income less than expenses, 185 (51.1%) students as income equal to expenses, and 128 (35.4%) students as income more than expenses. 196 (54.1%) of the students spent most of their lives in the province, 136 (37.6%) in the district, and 30 (8.3%) in the village.

Table 4. Digital Literacy and Artificial Intelligence Anxiety Levels of Participants

	n	**Min.**	**Max.**	$\overline{X}$	**SD**
Digital Literacy	362	10,00	50,00	37,27	7,35
Artificial Intelligence Anxiety	362	16,00	80,00	46,17	14,21
Learning	362	5,00	25,00	12,71	4,42
Job change	362	4,00	20,00	11,99	4,16
Sociotechnical blindness	362	4,00	20,00	12,64	4,23
Artificial intelligence configuration	362	3,00	15,00	8,81	3,63

According to Table 4, the minimum score that participants could get from the Digital Literacy Scale was recorded as 10.00, the maximum score was recorded as 50.00, while their average was calculated as 37.27 and their standard deviation was calculated as 7.35. On the Artificial Intelligence Anxiety Scale, the minimum score they could get was recorded as 16.00, the maximum score was recorded as 80.00, while their average was calculated as 46.17 and their standard deviation was calculated as 14.21. Values for learning sub-dimension was recorded as minimum 5.00, maximum 25,00 average 12,71 and standard deviation 4.42; for job change sub-dimension was recorded as minimum 4.00, maximum 20,00 average 11,99 and standard deviation 4.16; for sociotechnical blindness sub-dimension was recorded as minimum 4.00, maximum 20,00 average 12,64 and standard deviation 4.23; for artificial intelligence configuration sub-dimension was recorded as minimum 3.00, maximum 15,00 average 8,81 and standard deviation 3.63. According to results, it can be said that participants' DL levels are high and AIA are at a moderate level.

Table 5. Independent Samples T-test results by gender

	Gender	n	$\overline{X}$	SD	t	p
Digital Literacy	Female	130	3,7046	,66959	-,452	,652
	Male	232	3,7397	,77178		
Artificial Intelligence Anxiety	Female	130	2,9875	,89496	1,626	,105
	Male	232	2,8289	,88146		
Learning	Female	130	2,5877	,86580	,715	,475
	Male	232	2,5190	,89616		
Job change	Female	130	3,1327	1,04556	1,823	,069
	Male	232	2,9246	1,03547		
Sociotechnical blindness	Female	130	3,2500	1,08326	1,195	,233
	Male	232	3,1099	1,04513		
Artificial intelligence configuration	Female	130	3,1103	1,18735	2,033	**,043**
	Male	232	2,8434	1,21672		

When Table 5 is examined, no significant difference was found between digital literacy, artificial intelligence anxiety and learning, job change, and sociotechnical blindness sub-dimensions according to gender (p>.05), while a significant difference was found in favor of women between the artificial intelligence configuration sub dimension scores (p<.05).

Table 6. One-way ANOVA test results by grade level

	Grade	n	$\overline{X}$	SD	F	p	Meaningful Difference
Digital Literacy	1. Grade	83	3,6446	,63903	3,839	**,010**	3.Grade>4.Grade-2.Grade-1.grade
	2. Grade	72	3,5931	,79014			
	3. Grade	72	3,9694	,66367			
	4. Grade	135	3,7200	,77438			
Artificial Intelligence Anxiety	1. Grade	83	2,8404	,73000	,106	,957	-
	2. Grade	72	2,8889	,91653			
	3. Grade	72	2,9158	,97217			
	4. Grade	135	2,8963	,92319			
Learning	1. Grade	83	2,4916	,72334	,205	,893	-
	2. Grade	72	2,5361	,95877			
	3. Grade	72	2,6028	,93597			
	4. Grade	135	2,5481	,91324			
Job change	1. Grade	83	2,9729	,89886	,041	,989	-
	2. Grade	72	3,0174	1,06837			
	3. Grade	72	2,9826	1,15774			
	4. Grade	135	3,0148	1,05703			
Sociotechnical blindness	1. Grade	83	3,1506	,95392	,030	,993	-
	2. Grade	72	3,1354	1,10850			
	3. Grade	72	3,1597	1,08872			
	4. Grade	135	3,1796	14,92			
Artificial intelligence configuration	1. Grade	83	2,8313	1,05970	,356	,785	-
	2. Grade	72	2,9769	1,21972			
	3. Grade	72	3,0231	1,27370			
	4. Grade	135	2,9407	1,26757			

As seen in Table 6, a significant difference was found only in digital literacy (p<.05). As a result of the post-hoc analysis, a significant difference was found in favor of the 3rd grade in digital literacy scores among all grades (p<.05).

Table 7. ANOVA test results according to family income

	Family Income	n	$\overline{X}$	Sd	F	p	Meaningful Difference
Digital Literacy	Income less than expenses	49	3,4531	,83892	5,610	**,004**	Income more than expenses> Income less than expenses Income equal to expenses > Income less than expenses
	Income equal to expenses	185	3,7092	,71435			
	Income more than expenses	128	3,8578	,69832			
Artificial Intelligence Anxiety	Income less than expenses	49	2,8597	,98916	,847	,429	-
	Income equal to expenses	185	2,9436	,85229			
	Income more than expenses	128	2,8125	,90030			
Learning	Income less than expenses	49	2,4898	,92291	1,551	,213	-
	Income equal to expenses	185	2,6227	,86986			
	Income more than expenses	128	2,4500	,88771			
Job change	Income less than expenses	49	3,0306	1,18765	,417	**,**659	-
	Income equal to expenses	185	3,0378	1,01547			
	Income more than expenses	128	2,9316	1,02705			
Sociotechnical blindness	Income less than expenses	49	3,1173	1,16044	,648	,524	-
	Income equal to expenses	185	3,2216	1,00316			
	Income more than expenses	128	3,0879	1,10144			
Artificial intelligence configuration	Income less than expenses	49	2,9048	1,30171	,237	,789	-
	Income equal to expenses	185	2,9820	1,19516			
	Income more than expenses	128	2,8906	1,20665			

As is seen in Table 7, a significant difference was found between the digital literacy scores of the participants according to their family income ($p<.05$). As a result of post-hoc analysis, there is a significant difference in favor of the income more than expenses between income more than expenses and income less than expenses; and there is a significant difference in favor of the income equal to expenses between income less than expenses ($p<.05$). No significant difference was found between artificial intelligence anxiety and its sub-dimensions according to family income status ($p>.05$).

Table 8. One-way ANOVA test results according to the place with the longest lifespan

	The place with the longest lifespan	n	$\bar{X}$	SD	F	p	Meaningful Difference
Digital Literacy	Province	196	3,8260	,69761	7,145	**,001**	Province > Village District > Village
	District	136	3,6765	,74816			
	Village	30	3,3100	,77875			
Artificial Intelligence Anxiety	Province	196	2,8881	,92142	,170	,844	-
	District	136	2,8644	,85991			
	Village	30	2,9688	,81469			
Learning	Province	196	2,5663	,91522	,184	,832	-
	District	136	2,5265	,84039			
	Village	30	2,4733	,90284			
Job change	Province	196	3,0000	1,05338	,002	,998	-
	District	136	2,9963	1,02785			
	Village	30	3,0083	1,07174			
Sociotechnical blindness	Province	196	3,1480	1,09915	,438	,646	-
	District	136	3,1397	1,03493			
	Village	30	3,3333	,91287			
Artificial intelligence configuration	Province	196	2,9286	1,21880	1,169	,312	-
	District	136	2,8848	1,20450			
	Village	30	3,2556	1,18640			

Table 8 indicates that a significant difference was found only in digital literacy according to the place where the participants lived the longest ($p<.05$). Post-hoc analyses were applied, and a significant difference was found between the province and the village in favor of the province; and between the district and the village in favor of the district ($p<.05$). There is no significant difference between the artificial intelligence anxiety and its sub-dimensions ($p>.05$).

Table 9. Relationship between digital literacy and artificial intelligence anxiety

		Artificial intelligence anxiety	Learning	Job change	Sociotechnical blindness	Artificial intelligence configuration
Digital Literacy	Pearson r.	**-,115***	**-,160***	**-,120***	-,031	-,080
	p	,029	,002	,022	,552	,126
	n	362	362	362	362	362

Table 9 shows that there is a negative, weak significant relationship between "digital literacy" and "artificial intelligence anxiety"; between "digital literacy" and the "learning" sub-dimension; and between "digital literacy" and "job change". As the digital literacy score increases, the artificial intelligence anxiety score decreases.

DISCUSSION

In the study, the relationship between digital literacy and artificial intelligence anxiety of preservice PE teachers was examined, and the findings were discussed in the context of the relevant literature.

The participants' DL average was calculated as 37.27. Considering the maximum (50.00) and minimum values (10.00) that can be taken from the scale, it can be said that the participants'

DL levels are high. Üstündağ et al. (2017) concluded that the pre-service teachers had a high level of DL. Atar and Bağcı (2023) concluded that the DL scores of pre-service English teachers varied between medium and high. Liza and Andriyanti (2020) concluded in their study with pre-service teachers that the participants' DL scores were high. Adi et al. (2023) stated that pre-service physical education teachers who use technological devices more have higher computer literacy. When the studies are examined, it can be explained that the high DL scores of pre-service teachers, despite the different sample groups, can be explained by the fact that they are "digital natives", which was first defined by Prensky (2001) as "those born after 1980 and who can easily find digital information using electronic devices such as mobile phones and computers". However, it is thought that more studies are needed in literature on this subject in order to generalize this situation for pre-service physical education teachers, and this situation is also stated in the same way by Adi et al. (2023).

The participants' AIA average was calculated as 46.17 and considering the maximum and minimum scores that could be obtained, it was determined that the participants' AIA were at a moderate level. Doğan et al. (2023) concluded in their study that the attitudes of sports science faculty students towards artificial intelligence are positive. In their study with students of the faculty of sports sciences, Savaş et al. (2024) reported that the participants had a moderate level of AIA. Sevimli Deniz (2022) worked with science and social studies teachers and reported that they had a moderate level of artificial intelligence anxiety. In their study with university students studying at different faculties, Takıl et al. (2022) reported that the students had a moderate level of artificial intelligence anxiety. When the study results are considered, it is seen that similar results were obtained. A medium level of anxiety suggests that individuals are neither completely resistant to technology nor completely accepting but rather are in a cautious and observant position. In addition, since university students have not yet entered professional work life, their uncertainty about the possible effects of artificial intelligence on their professional future may also be effective in the formation of this medium level of anxiety.

No significant difference was found between the DL scores according to the gender variable. Brata et al. (2022) concluded that the gender variable did not create a significant difference for DL. Similarly, Kozan and Bulut Özek (2019) concluded that DL scores did not differ according to the gender variable. Argelagós and Pifarré (2017) also stated that gender is not a predictor in solving problems encountered in the digital world. However, Long et al. (2023) reported in their study with adult Indonesian individuals that men had a higher DL score than women. Rizal et al. (2021) stated that DL scores differed significantly in favor of men. In Kıyıcı's (2008) study with preservice teachers studying at education faculties, it was determined that male preservice teachers had higher DL scores. Considering the results, it can be said that the effect of gender on DL scores may vary according to different sample groups, study contexts and methods, and that gender is not a variable that definitely makes a difference for DL as today's world may offer almost everyone equal chances to reach everything. The current generation, regardless of gender, possesses digital citizenship as they are called as digital natives (Prensky, 2001), then, the absence of a significant difference according to gender variable in DL levels may be regarded as an expected outcome.

While there were no significant differences between AIA, sub dimensions of learning, job change, sociotechnical blindness of participants according to gender, a significant difference was found in favor of women in the artificial intelligence configuration sub-dimension, and it was observed that women had higher artificial intelligence configuration anxieties. In their study, Heinsch and Handke (2024) highlighted the anxieties of female educators regarding biases in robot interactions and stated that female participants believed that human-like AI perpetuates gender stereotypes, leading to lower levels of confidence and higher anxiety regarding its use in teaching and learning environments. Terzi (2020) concluded that female participants generally showed more anxiety about humanoid AI compared to male participants due to concerns about the unexpected consequences of AI behaviors. Turchioe et al. (2023) stated that women are more anxious about the use of AI-based health technology. These results show that anxieties about AI technologies may vary depending on gender differences, and female participants, in particular, have higher levels of anxiety about the possible negative effects of human-like AI than men. This situation highlights the importance of taking gender perspective into account in studies on artificial intelligence acceptance and perception. Although no significant difference was found in the general level of anxiety about artificial intelligence in terms of gender, it is thought that especially female pre-service teachers' participation in extra training, seminars, etc. on artificial intelligence technologies and products will reduce their anxiety levels so that they can better adapt to the changing needs of the age.

Another result obtained in the study is that the DL scores of pre-service PE teachers are significant in favor of the 3rd graders. In the study conducted by Özerbaş and Kuralbayeva (2018) examining the DL scores of pre-service teachers, a significant result was obtained in favor of the 3rd graders. In their study with Computer and Educational Technologies students, Kozan and Bulut Özek (2019) concluded that scores of DL increased as the class level increased. In addition, Özcan (2022) stated that the digital literacy scores increased as the grade increased. However, Yontar (2019) concluded that there was no significant difference between DL scores according to the grade level. In his study, Aslan (2021) concluded that the grade level did not make a significant difference. Öngören (2021) similarly stated that digital literacy does not differ according to grade level. All the findings show that the idea DL differs according to grade level is controversial in literature. While some studies indicate that DL increases as the grade level increases, other studies state that there is no significant relationship. This situation suggests that individual and environmental factors may be effective in the development of digital literacy. Therefore, it can be concluded that the educational opportunities offered by universities, technological infrastructure and individual efforts may play an important role in the differentiation of digital literacy according to the grade level.

No significant difference was found between AIA, its sub-dimensions according to the grade level variable. Uçar et al. (2024) reported that 1st and 2nd grade students had lower AIA than 3rd and 4th grade students. In their study with preservice Turkish language teachers, Eyüp and Kayhan (2023) stated that AIA did not differ significantly according to the grade variable. Ayduğ and Altınpulluk (2023) stated in their study that second-grade preservice teachers

experienced higher artificial intelligence anxiety compared to other grades. It is thought that the differences between the studies may be due to structural differences in the sample groups but may also be related to how much the curriculum supports or covers artificial intelligence/technology topics. While this situation shows the importance of adding content on artificial intelligence regardless of grade level, it is possible to say that students' increased engagement with artificial intelligence, which is seen as one of the biggest technological developments of the day, can replace artificial intelligence anxiety with the active and efficient use of artificial intelligence.

According to family income variable, a significant difference was found in the DL scores between “income more than expenses” and “income less than expenses” in favor of “income more than expenses”; and between “income and expenses equal” and “income less than expenses” in favor of “income and expenses equal”. When the literature is examined, there are studies that have similar findings. Kıyıcı (2008), in the study with pre-service teachers from five different universities and eight different branches, concluded that individuals with higher income levels also have higher DL scores. Similarly, Acar (2015) concluded that income status affects the view of parents on DL positively. In their study, Yeşildal and Kaya (2021) examined and reported that DL scores increased as the income status increased. The similarities in the study results can also be explained by the fact that higher income makes it easier for individuals to access technology and also the internet, so individuals with higher economic well-being can more easily meet their basic needs, allowing these individuals to spend more time with technology, and acquire digital skills. Additionally, Akkoyunlu et al. (2010) stated that DL scores are expected to increase with the increase in income, the purchase of more advanced technology devices and shorter access to the internet.

There is no significant difference between AIA, its sub-dimensions according to income status. Şen (2024) revealed that income status does not affect the AIA scores of public employees. In a similar way, Özbek (2024) stated that artificial intelligence anxiety did not create a significant difference according to income status. Although the study results were similar, the differences in the sample groups created a limitation in the generalizability of the results, indicating that further research may be needed.

According to the variable *the place with the longest lifespan*, a significant difference was found in the DL scores between “province” and “village” in favor of “province”, and between “district” and “village” in favor of “district”. In the study conducted by Utli and Filoğlu Ersü (2023), it was determined that those living in the province had higher DL scores than those living in districts and villages. Joshkun et al. (2024) stated in their study that having an internet connection at home has a significant impact on digital literacy. It is thought that this is due to the differences in the level of access to technology in the region where we live. This difference may be due to individuals living in larger cities having faster access to technological resources and better internet infrastructure.

No significant difference was found between the AIA scores according to the variable *the place with the longest lifespan*. In their study, Aktaş Reyhan and Dağlı (2023) did not find any significant differences between AIA according to the place of residence for the longest

time. However, Kazak (2023) stated that those living in metropolitan cities had lower AIA than those living in both districts and villages. It is thought that the difference between the study results may be due to demographic, methodological or socio-cultural differences.

When the relationship between DL and AIA was examined, a negative, weak and significant relationship was found between DL and AIA; between DL and learning sub-dimension; and between DL and job change sub-dimension. It was concluded that as the DL score increased, the AIA score decreased. In support of the current study, Kaşıkcı's (2024) study that AIA would decrease as the DL increased. Lim (2023) reported that AIA was associated with attitudes towards AI. Ng et al. (2021) stated that teachers with a high level of digital literacy will not hesitate to use artificial intelligence products. Long and Magerko (2020) reported that high digital literacy may play a role in reducing anxiety about artificial intelligence and its use. In this context, it is thought that the level of digital literacy is negatively related to artificial intelligence anxiety and that an increase in digital literacy help to affirm this situation.

CONCLUSION AND RECOMMENDATIONS

In this study, the relationship between the digital literacy (DL) levels of preservice physical education teachers and their artificial intelligence anxieties (AIA) were examined; it was revealed that their DL levels were high, and their AIA levels were moderate. Additionally, a negative, weak but significant relationship was found between DL and AIA. The results show that preservice teachers' attitudes towards technological developments and especially artificial intelligence applications are closely related to their digital literacy competencies (Ng et al., 2021; Long and Magerko, 2020). For this reason, it is important to include content in the teacher education curriculum not only on the use of digital tools but also on the pedagogical, ethical and psychological dimensions of artificial intelligence technologies. Since the development in the DL reduces AIA, workshops supported by technical skills, ethical discussions on AI, case studies and critical perspective development exercises, and systematic inclusion of educational experiences with AI tools in curriculum programs may produce positive results. In this way, it is thought that preservice teachers will increase their sense of confidence provided by concrete experiences rather than abstract fears.

Although there was no significant difference between DL scores according to the gender variable, it was found that the AIA levels of female participants were significantly higher than males' in the *artificial intelligence configuration* sub-dimension. It is also stated in the literature that female individuals develop higher levels of anxiety towards human-like artificial intelligence technologies (Heinsch and Handke, 2024; Terzi, 2020). In this context, it is recommended that learning environments that take gender-based differences into account and reduce anxiety levels be designed and supportive educational practices be developed.

The fact that digital literacy scores differ significantly according to demographic variables such as grade level, family income status and the place with the longest lifespan shows that individual and environmental factors are decisive in the development of digital skills. Particularly, students who study in higher grade levels, live in city centers and are in a better economic situation have higher digital literacy scores, which reveals that educational

opportunities and technological access levels have an impact on digital competence (Joshkun et al., 2024; Kıyıcı, 2008). In this regard, it is recommended that support programs be developed to increase access to digital resources within the scope of teacher training programs in order to eliminate socioeconomic disparities. On the other hand, no significant difference was found in the level of AIA according to these variables.

As a result, the relationship between DL and AIA needs to be addressed with a more holistic approach in the teacher training process. UNESCO (2021) emphasizes that it is essential for teachers to not only have access to technology in the age of digital transformation, but also to be able to use technology creatively, critically and ethically for sustainable education. In this context, policy reforms that include digital literacy and AI in teacher competencies should be urgently implemented in cooperation with the Council of Higher Education and the Ministry of National Education. Thus, not only the individual professional development of preservice teachers but also their contribution to the digital transformation of the education system will be supported.

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