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Investigation of Artificial Inteligence Awareness Among Pre-Service Teachers With Cluster Analysis

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Abstract: This study investigates the patterns of artificial intelligence (AI) awareness among pre-service teachers at Mersin University, using both descriptive and inferential analyses to examine the levels of knowledge and attitudes towards AI. Understanding educators' AI awareness is essential as AI is increasingly integrated into education. A sample of 117 pre-service teachers completed the Artificial Intelligence Awareness Scale for Teachers, measuring Practical Knowledge, Beliefs and Attitudes, Attitude to Association, and Theoretical Knowledge. Statistical analysis were conducted to assess differences in AI awareness across demographic variables, including gender, academic department, and technology use. In addition, cluster analysis was performed, revealing three distinct clusters: (1) a moderate-awareness cluster, characterized by average levels of AI knowledge and attitudes across all dimensions; (2) a low-awareness cluster, characterized by limited AI knowledge and neutral-to-negative attitudes; and (3) a high-awareness cluster, characterized by strong AI knowledge and positive attitudes toward artificial intelligence. The findings that technology usage significantly influences pre-service teachers' AI awareness levels, whereas demographic factors such as gender and academic department do not. The results emphasize the need for differentiated AI training within teacher preparation programs, suggesting foundational AI literacy training for lower-awareness groups and more advanced content for those already possessing higher awareness.
Keywords: Artificial intelligence awareness, pre-service teachers, cluster analysis, teacher education, technology integration in education.

Öğretmen Adaylarında Yapay Zeka Farkındalığının Demografik Değişkenler ve Kümeleme Analizi ile İncelenmesi

Öz: Bu çalışma, Mersin Üniversitesi'ndeki öğretmen adaylarının yapay zeka (YZ) farkındalık düzeylerini araştırarak, YZ bilgi ve tutumlarındaki farklılıkları incelemek için hem betimsel hem de çıkarımsal analizler kullanmaktadır. Çalışmada, 117 öğretmen adayı, Pratik Bilgi, İnanç ve Tutumlar, Birleştirici Tutum ve Teorik Bilgi boyutlarını ölçen Öğretmenler için Yapay Zeka Farkındalık Ölçeği'ni tamamlamıştır. Demografik değişkenler (cinsiyet, bölüm ve teknoloji kullanım süresi) bazında YZ farkındalık düzeylerini değerlendirmek için istatistiksel analizler yapılmıştır. Ayrıca, katılımcılar arasında gerçekleştirilen kümeleme analizi sonucunda üç farklı grup ortaya çıkmıştır: (1) tüm boyutlarda ortalama YZ farkındalığına sahip, orta düzey farkındalık kümesi; (2) sınırlı YZ bilgisi ve nötrden olumsuza doğru tutum sergileyen, düşük düzey farkındalık kümesi; ve (3) güçlü YZ bilgisine ve olumlu tutumlara sahip, yüksek düzey farkındalık kümesi. Bulgular, teknoloji kullanımının öğretmen adaylarının YZ farkındalık düzeyleri üzerinde anlamlı bir etkisi olduğunu; ancak cinsiyet ve akademik bölüm gibi demografik faktörlerin anlamlı bir farklılığa neden olmadığını göstermektedir. Elde edilen sonuçlar, öğretmen yetiştirme programları içinde farklı düzeylerdeki YZ farkındalığına sahip gruplara göre özelleştirilmiş eğitimlere ihtiyaç duyulduğunu, bu bağlamda düşük farkındalığa sahip gruplar için temel düzey YZ okuryazarlığı eğitiminin, daha yüksek farkındalığa sahip gruplar için ise ileri düzey içeriklerin sunulması gerektiğini ortaya koymaktadır.
Anahtar Kelimeler: Yapay zeka farkındalığı, öğretmen adayları, kümeleme analizi, öğretmen eğitimi, eğitimde teknoloji entegrasyonu.

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Introduction

Artificial Intelligence (AI) has the ability to process massive amounts of data, identify patterns, and simulate human decision making like never before. Over the past few years, AI has made extraordinary progress, particularly through the development of advanced machine learning and neural networks. Rapid advances in AI have excited and alarmed the public. This technological revolution has begun to change the paradigms of problem solving, decision making and digital systems in general. And as an inevitable consequence, AI literacy is increasingly recognized as an essential skill that all individuals must possess to bridge the digital divide and actively participate in society (UNESCO, 2022).

AI in Education

Many years ago, Artificial Intelligence (AI) started to be used in many fields of education. It is believed that AI can bring personalization of learning experience, enhanced student engagement and greater administrative efficiency to the teaching and learning processes within educational practices (BaHammam, 2023). Some early efforts are already underway to integrate AI education into the core curricula of primary and secondary schools. A separate subject on AI in schools will provide more detailed, holistic knowledge of the subject, with input from computer science and mathematics and statistics, as well as ethical considerations relevant to other specific industries. Educators teach and train students to be stewards of AI literacy, socially responsible and ethically aware in the use of this technology.

AI is expected to significantly influence the development of educational technology environments, especially through active collaboration with educators (U.S. Department of Education, Office of Educational Technology, 2023). This implies that there is a task to raise awareness of educators about the requirements and implications emerging from the application AI within a holistic approach to a practical application of AI technologies in the educational settings. Research has revealed that the development of a standardized or recommended AI curriculum, as put forth for radiology trainees, could work towards addressing the perceived knowledge gaps and enhancing confidence in utilizing AI technologies in radiography (Rainey et al., 2021). Similarly, within general educational contexts, introducing a structured AI curriculum is crucial for enhancing educators' AI competencies and awareness. For instance, a study conducted by Chiu et al., (2021) highlighted the creation and assessment of an AI curriculum at the pre-tertiary education level, finding positive impacts on students' perceptions and motivation toward AI learning. These findings underscore the importance of systematically designed curricula for effectively integrating AI into educational settings. Educators are expected to work with AI in the current education environment, which requires a clear and diversified representation from those who develop this technology along with an understanding of both its uses and limitations translating into practical strategies that ease educator lives within educational contexts like otherwise impossible while enhancing their utilization of such technologies as opposed to minimizing challenges posed by them.

AI Awareness

From the literature reviewed on AI awareness, it was clear that AI awareness is not a definition known by just the term AI itself. It is multi-faceted construct involving: procedural knowledge, beliefs (e.g., how authorities are based), associational skills and theoretical information as well (Touretzky et al., 2019). This involves knowing the ethical issues involved, artificial systems bias and social consequences. This literacy also extends to the potential impact of AI on society, self-efficacy in learning AI, and awareness of AI ethics. In other words, this constructs behavioral intention for AI. That is, AI literacy was also found to correlate with issue identification: the more literate one is when it comes to using AI for social good (beyond simply understanding how neural networks work), the greater their comfort and confidence working in public interest tech. Similarly, AI literacy is expected to be combined with prompt engineering and critical thinking that will distinguish the chief purpose of integrating AI into real classroom practice (Walter, 2024). In other words, in teachers' education, reaching the state of next level (capacity to evaluate AI technologies critically as well as knowledge of how to communicate and collaborate with AI successfully) where they would be able to employ these tools in educational settings appropriately—beyond just being aware about them (Du, 2014). Now the studies have proved this more solidly: that artificial intelligence or AI is generally becoming part of learning hence are showing an increasing impact on education which has to highlight nurturing schools and teachers' skills in AI. While the ethical dilemma around AI in education and how we should use it is an entirely different topic, that would still only give us more reason to work on creating confidence among teachers. The research by Zhao, Hwang and Li (2022) emphasized that how to advance AI literacy among teachers could enhance classroom efficiency and also facilitate the adoption of AI literacy. Hence, in order to understand the relationships among factors of AI literacy across levels of teaching practice to place students learning experiences into better context. We hope our study will motivate educators, policymakers, and stakeholders to work together on how AI in education could be exploited most positively without losing control of relevant risks. The primary goal of professional development in AI literacy is to enhance educators' competencies, knowledge, and practical skills related to artificial intelligence, enabling effective integration of AI into their teaching practices. Professional development programs focused on AI literacy provide educators with foundational knowledge about AI technologies, their ethical implications, and practical strategies for classroom implementation (Nazaretsky et al., 2022). Effective

professional development specifically targets enhancing teachers' Technological Pedagogical Content Knowledge (TPACK), thereby empowering educators to strategically employ AI tools within their pedagogical frameworks to improve student learning outcomes (Mishra & Koehler, 2006; Nazaretsky et al., 2022).

Growing AI brought a new era, and necessitated rethinking different roles teachers have taken over time collectively as educators; moving well beyond job duties need more attention when it comes to perceive changes in the evolving education with help of an artificial intelligence assistant. At the same time, as AI is expanding its reach within education, it seems important to investigate how teachers experience and are prepared for this technology in their teaching practice.

Effective integration of AI-supported educational technologies requires the establishment of trust among educators and stakeholders. Trust-building is critical for embedding AI tools seamlessly into STEM curricula, promoting sustained adoption, and maximizing educational effectiveness (Chiu & Chai, 2020). When trust is effectively cultivated, AI-supported technologies facilitate enriched, inquiry-based learning environments in STEM education, promoting creativity, innovation, and critical thinking (Chiu & Chai, 2020). The teachers' practical and theoretical knowledge of AI in K-12 education specifically forms their confidence with the use of AI. Moreover, Nazaretsky et al. (2022) also suggest that the development of a well-designed integrated K-12 AI curriculum necessitates educators to collaboratively design systems so as to know what knowledge and competences are essential for students in an era shaped by this technology. This type of coordinated work with educators, decision-makers and relevant stakeholders to craft systemic AI literacy programs will also have be heavily backed by extensive teacher professional development that can help realize optimal benefits from the deployment of educational uses of AI (Nazaretsky et al., 2022). At the same time, there is a need for creative ways of delivering education for all professions that can adapt the educational strategies of educators and institutions to the changing needs of healthcare education. The need for a content framework in the integrated education within universities and educational programs itself, is emerging as AI technology starts taking focus along with ethical consideration for this to happen (Lee, 2024).

Identifying distinct AI awareness profiles among pre-service teachers is essential for designing targeted interventions tailored to educators' diverse knowledge bases and beliefs. Understanding these profiles helps educators and policymakers address specific knowledge gaps, promoting effective AI integration across varied educational contexts. AI awareness profiles offer valuable insights, guiding teacher preparation programs to customize professional development initiatives to meet diverse educator needs, thus fostering greater comfort, confidence, and competence in leveraging AI technologies (Zhao et al., 2022).

Finally, Enhancing AI literacy among educators is critical for equipping students with the necessary skills to navigate an increasingly AI-driven society. Educators proficient in AI not only facilitate effective teaching and learning but also foster ethical and responsible AI use among students. Therefore, prioritizing AI awareness in teacher education programs contributes to building a future-oriented educational workforce prepared to leverage AI responsibly and effectively. A heightened emphasis on AI literacy enables educators to confidently navigate ethical challenges and optimize AI technologies for educational benefit (Nazaretsky et al., 2022; Lee, 2024; Zhao, Watterston & Tröhler, 2022).

Importance of the study

For AI integration into educational context, it is a fundamental first step in knowing the AI awareness of pre-service teachers, as it will have an impact on how they can integrate AI tools into educational contexts when at school. Recent research has shown that awareness and comprehension of AI play a role in how teachers perceive AI technologies, which consequently influences their adoption in educational settings (Flavián et al., 2021). This awareness is particularly important when considering pre-service teachers who will influence future educational practices. Understanding how informed future educators are around AI, in such categories as practical understanding, theoretical knowledge and perceptions provides valuable insights into preparedness to teach within an AI-supported learning environment.

Moreover, identifying and analyzing clusters of AI awareness among pre-service teachers provides valuable insights into distinct patterns and categories related to their knowledge, attitudes, and preparedness to integrate AI in educational contexts. Existing research indicates that pre-service teachers display varied levels of acceptance and understanding of AI, with clear differences in their competencies and confidence regarding its application (Nazaretsky et al., 2022; Zhao et al., 2022). Cluster analysis can help pinpoint specific groups of pre-service teachers who might require targeted support or interventions due to lower levels of AI literacy, while simultaneously highlighting groups with advanced proficiency and openness to AI integration (Lee, 2024). Such detailed profiling is crucial for informing teacher education programs, enabling them to strategically tailor their professional development offerings to address diverse needs effectively, thereby optimizing the integration of AI technologies into educational practices (Chiu et al., 2021; Nazaretsky et al., 2022).

An understanding of demographic variables on AI awareness among pre-service teachers may be required to develop interventions which are focused and supportive. Beyond informing teacher preparation programs and professional development efforts, understanding how factors like gender, academic department or technology usage patterns are associated with AI awareness can help shape the educational technology landscape (Pérez & Vélez-Jaramillo, 2021). Further, the demographic attributes mentioned above in connection with these AI awareness clusters can also be used to understand more about characteristics and requirements related to different groups which would help cater people accordingly leading towards a personalized approach for effective communication (Mansor et al., 2022).

In addition, this study's focus on multiple dimensions of AI awareness -including practical knowledge, beliefs and attitudes, theoretical knowledge, and overall AI awareness may offer a comprehensive understanding of pre-service teachers' readiness to integrate AI in their future classrooms. This research, analyzing the numerous factors linked with AI literacy and their associations to teachers' demographic features and cluster memberships contributes more in understanding them (Kwak, Ahn & Seo, 2022). It will be important to design targeted interventions to boost AI competence of pre-service teachers and equipping them appropriately well enough before they engage with the use of AI technologies in their teaching practices (Krakowski et al., 2022).

In conclusion, this study's importance lies in its potential to inform the development of more effective teacher education programs that support AI through both AI awareness and cluster analysis. By realizing that not only what future educators know about AI where they are now, but also the buckets and clusters into which this knowledge naturally falls will better allow educational institutions to make their interventions more focused. Such a dual understanding of AI consciousness can be useful in formulating more nuanced and sophisticated strategies to prepare teachers, which could enhance the practices significantly for effective teaching innovations in digital era.

Purpose of the study

This is a growing field and the successful integration of AI in education, depends on whether or not educators are aware about it and willing to use AI tools. In this study, it is aimed to determine the AI awareness and attitudes of pre-service teachers at Mersin University according to different variables such as gender, academic department etc. Using cluster analysis, the study will address subclassifying patterns of AI awareness among participants to get a better understanding about different groups in teacher education context. Such analysis will reveal the different levels of readiness and mental maps regarding AI that are fundamental for an efficient implementation or diffusion to educational applications. The research will address three primary questions:

- Are there significant differences in AI awareness levels among pre-service teachers based on demographic variables, such as gender, academic department, and technology usage?
- What are the distinct clusters of AI awareness and attitudes among pre-service teachers based on Practical Knowledge, Belief and Attitude, Attitude to Association, Theoretical Knowledge, and AI Awareness Mean Score?
- How do the identified clusters of AI awareness provide information about the AI needs of different groups of pre-service teachers?

Method

Research Model

This study employed a quantitative research design using the descriptive survey model to investigate the AI awareness levels of pre-service teachers at Mersin University, Türkiye. The aim was to identify the overall level of AI awareness and investigate potential differences based on selected demographic variables. The descriptive survey model is commonly used in educational research to collect data that reflect participants' current attitudes, opinions, and awareness about a particular phenomenon (Fraenkel et al., 2012; Karasar, 2014). In this study, we examined the effects of various demographic variables on university students' awareness of artificial intelligence (AI) and its related subscales. The target population consisted of pre-service teachers enrolled in various teacher education programs at the Faculty of Education during the 2023-2024 academic year.

Sampling and Participants

A convenience sampling technique was used to recruit participants for the study. Pre-service teachers were invited to participate voluntarily through an online form distributed via email and social media platforms.

Table 1.
Findings related to the age variable of pre-service teachers

Age	f	%
18	3	2.5
19	11	9.4
20	32	27.3
21	37	31.6
22	21	17.9
23 and higher	13	11.1
Total	117	100,0

When Table 1 is analyzed, it is seen that 2.5% of the pre-service teachers are 18 years old, 9.4% are 19 years old, 27.3% are 20 years old, 31.6% are 21 years old, 17.9% are 22 years old, 11.1% are 23 years old and older.

Table 2.
Gender distribution of pre-service teachers

Gender	f	%
Female	79	62.52
Male	38	32.48
Total	117	100.0

When Table 2 is analyzed, it is seen that 62.52% of the pre-service teachers are female and 32.48% are male.

Table 3.
Findings related to the department variable of pre-service teachers

Department	f	%
Department of Primary Education	14	12
Department of Mathematics and Science Education	56	47.86
Department of Foreign Language Education	8	6.8
Department of Turkish and Social Sciences Education	24	20.5
Department of Guidance and Psychological Counseling	15	12.82
Total	117	100,0

When Table 3 is examined, according to the department variable, 12% of the pre-service teachers are studying in the Department of Primary Education, 47.86% are studying in the Department of Mathematics and Science Education, 6.8% are studying Department of Foreign Language Education, 20.5% are studying Department of Turkish and Social Sciences Education and 12.82% are studying Department of Guidance and Psychological Counseling.

Table 4.
Findings related to the GPA of pre-service teachers

GPA	f	%
1.00-1.99	1	0.85
2.00-2.49	5	4.27
2.50-2.99	42	35.89
3.00-3.49	56	47.86
3.50-4.00	13	11.11
Total	117	100,0

When Table 4 is examined, according to the Cumulative GPA variable, 0.85% of the pre-service teachers have 1.00-1.99, 4.27% of pre-service teachers have 2.00-2.49, 35.89% of the pre-service teachers have 2.50-2.99, 47.86% of the pre-service teachers have 3.00-3.49 and 11.11% of the pre-service teachers have 3.50-4.00.

Table 5.
Findings related to status of having received AI training variable of pre-service teachers

AI Training	f	%
No	105	89.74
Yes	12	10.25
Total	117	100.0

When Table 5 is analyzed, it is seen that 89.74% of the pre-service teachers haven't get any AI training yet and 10.25% had AI training.

Table 6.
Findings related to the technology usage of pre-service teachers

Technology Usage	f	%
Less than 1 hour	9	7.69
1-3 hours	67	57.26
3-5 hours	33	28.20
More than 5 hours	8	6.83
Total	117	100,0

When Table 6 is examined, according to technology usage of pre-service teachers, 7.69% of the pre-service teachers have less than 1 hour, 57.26% of pre-service teachers have 1-3 hours, 28.20% of the pre-service teachers have 3-5 hours, 6.83% of the pre-service teachers have more than 5 hours.

Data Collection Instruments

The data were collected using two instruments: a demographic information form and the AI Awareness Scale for Teachers developed by Ferikoğlu and Akgün (2022). The demographic form gathered information about participants' age, gender, department and daily technology use.

The AI Awareness Scale for Teachers is a validated and reliable scale that measures teachers' AI awareness levels across four dimensions: Practical knowledge, beliefs and attitudes, ability to associate and theoretical information. The scale consists of 51 items rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Ferikoğlu & Akgün (2022) reported good internal consistency for the overall scale ($\alpha = 0.98$).

This study was conducted under the application permission was obtained from Mersin University Social and Human Sciences Ethics Committee with the decision dated 15/03/2024 and numbered 112 that the collection of research data is ethically appropriate.

Data Analysis

The collected data were analyzed using the Statistical Package for Social Sciences (SPSS) software. Descriptive statistics, including means and standard deviations, were calculated to determine the overall AI awareness levels of education faculty students and their scores on the subscales.

Whether the data were normally distributed or not was examined through normal distribution curves and skewness-kurtosis values. To examine potential differences in AI awareness levels based on demographic variables gender, academic department, and technology usage, independent samples t-tests and one-way analysis of variance (ANOVA) were conducted. For non-normally distributed data or when assumptions of homogeneity of variances were not met, the Mann-Whitney U test was used. Cluster analysis using the K-means algorithm was also conducted to identify distinct groups of students based on their AI awareness scores and subscales. This analysis aimed to explore varying patterns of AI awareness among the participants.

Limitations

This study's limitations include a relatively small sample size for some academic departments and potential self-report biases in measuring AI awareness. Future research should aim to include larger and more diverse samples and consider using objective measures of AI literacy. Cluster analysis results may be influenced by sample size and participant diversity; thus, future research should aim to replicate findings with larger and more varied populations to strengthen generalizability.

Findings

The purpose of this study was to explore the determinants behind differences in pre-service teachers that exhibit various levels of AI awareness according their demographic characteristics such as gender, academic department and technology usage. The analysis was conducted using independent t-tests, Mann-Whitney U and ANOVA to compare AI awareness scores across these demographic categories. Examining how demographic characteristics may influence AI awareness among pre-service teachers is critical for educational researchers and policymakers, as demographic variables such as gender, academic department, and technology usage have been consistently shown to affect individuals' attitudes, awareness, and adoption of technology (Teo, 2008). Clarifying the role of these demographic differences helps educators and administrators develop targeted interventions, training programs, and strategies aimed at enhancing AI-related competencies among future educators. Such targeted approaches ensure that pre-service teachers acquire the necessary expertise and readiness to effectively integrate artificial intelligence into their professional teaching practices (Ertmer & Ottenbreit-Leftwich, 2010). Moreover, Cluster analysis was conducted to identify distinct groups within the sample based on participants' AI awareness and attitudes, allowing for a deeper understanding of varying levels of knowledge and perception toward AI. The following sections detail the statistical findings from these analyses, offering insights into how demographic differences may shape AI awareness levels among pre-service teachers.

Table 7:
T-Test Analysis Results by Gender

Variable	*t(df)*	*p*	Mean (Male)	SD (Male)	Mean (Female)	SD (Female)
Practical Knowledge	1.78	.077	3.95	0.41	3.73	0.57
Beliefs and Attitude	1.62	.108	3.79	0.55	3.56	0.63
Ability to Associate	0.94	.347	3.92	0.63	3.78	0.54
Theoretical Information	-0.35	.726	3.93	0.56	3.96	0.47
Total AI Awareness	1.28	.203	3.80	0.51	3.69	0.41

There was no significant difference in Practical Knowledge scores between males (M = 3.95, SD = 0.41) and females (*M* = 3.73, *SD* = 0.57), *t*(115) = 1.78, *p* = .077. There was no significant difference in Beliefs and Attitude scores between males (*M* = 3.79, *SD* = 0.55) and females (*M* = 3.56, *SD* = 0.63), *t*(115) = 1.62, *p* = .108. There was no significant difference in Ability to Associate scores between males (*M* = 3.92, *SD* = 0.63) and females (*M* = 3.78, *SD* = 0.54), *t*(115) = 0.94, *p* = .347. There was no significant difference in Theoretical Information scores between males (*M* = 3.93, *SD* = 0.56) and females (*M* = 3.96, *SD* = 0.47), *t*(115) = -0.35, *p* = .726. There was no significant difference in Total AI awareness scores between males (*M* = 3.80, *SD* = 0.51) and females (*M* = 3.69, *SD* = 0.41), *t*(115) = 1.28, *p* = .203. These results indicate that gender does not have a significant effect on Practical Knowledge, Beliefs and Attitude, Ability to Associate, Theoretical Information, Total AI Awareness scores. All variables met the assumptions of normality and homogeneity of variances.

Table 8:
ANOVA Analysis Results by Department

Variable	Source	df	MS	F	p	η^2
Practical Knowledge	Between Groups	4	0.14	0.55	0.696	0.019
	Within Groups	112	0.25			
	Total	116				
Beliefs and Attitude	Between Groups	4	0.02	0.09	0.987	0.003
	Within Groups	112	0.28			
	Total	116				
Ability to Associate	Between Groups	4	0.47	1.48	0.212	0.050
	Within Groups	112	0.32			
	Total	116				
Theoretical Information	Between Groups	4	0.42	1.60	0.180	0.054
	Within Groups	112	0.26			

Variable	Source	df	MS	F	p	η²
Total AI Awareness	Total	116				
	Between Groups	4	0.14	0.73	0.577	0.026
	Within Groups	112	0.20			
	Total	116				

There was no significant difference in Practical Knowledge scores among the different departments, *F(4,112)=0.55, p=.696, η2=0.019*. There was no significant difference in Beliefs and Attitude scores among the different departments, *F*(4,112)=0.09, *p*=.987, *η2*=0.003. There was no significant difference in Ability to Associate scores among the different departments, *F*(4,112)=1.48, *p*=.212, *η2*=0.050. There was no significant difference in Theoretical Information scores among the different departments, *F*(4,112)=0.68, *p*=.606, *η2*=0.024. There was no significant difference in Total AI Awareness scores among the different departments, *F*(4,112)=1.21, *p*=.310, *η2*=0.041.

The ANOVA results indicate that there are no significant differences in Practical Knowledge, Beliefs and Attitude, Ability to Associate, Theoretical Information, Total AI Awareness scores among the different departments. The assumptions of normality and homogeneity of variances are mostly met for all measures. Therefore, we can conclude that the department variable does not have a significant difference on AI awareness scores.

Table 9:
Mann-Whitney U Results by Technology Usage Level

Variable	Median (Less than 3 hours)	Median (More than 3 hours)	U	p
Practical Knowledge	3.81	4	1143.50	0.018
Beliefs and Attitude	3.61	3.86	1239.00	0.068
Ability to Associate	3.60	3.90	1053.50	0.004
Theoretical Information	3.68	3.91	1288.00	0.122
Total AI Awareness	3.69	3.9	1158.00	0.022

Since the assumptions of normality and homogeneity of variances were not met for the variable of technology usage level, non-parametric tests were deemed more appropriate. Specifically, the Mann-Whitney U test was employed to compare the AI awareness (Practical Knowledge, Belief and Attitude, Attitude to Association, Theoretical Knowledge, and Total AI Awareness) scores across groups categorized by daily technology use (less than 3 hours vs. more than 3 hours). As this test does not require the assumption of normally distributed data (Field, 2013).

Practical Knowledge: A significant difference was found between less than 3 hours of technology use (Median = 3.81) and more than 3 hours of technology use (Median = 4.00) groups, *U*=1143.50, *p*=.018, indicating that higher technology usage was associated with higher Practical Knowledge scores.

Belief and Attitude: The test did not reveal a statistically significant difference between less than 3 hours of technology use (Median = 3.61) and more than 3 hours of technology use (Median = 3.86), *U*=1239.00, *p*=.068.

Ability to Associate: There was a significant difference between less than 3 hours of technology use (Median = 3.60) and more than 3 hours of technology use (Median = 3.90) in Attitude to Association scores, *U*=1053.50, *p*=.004.

Theoretical Knowledge: No significant difference was observed between less than 3 hours of technology use (Median = 3.68) and more than 3 hours of technology use (Median = 3.91) in Theoretical Knowledge scores, *U*=1288.00, *p*=.122.

Total AI Awareness: A significant difference was found between less than 3 hours of technology use (Median = 3.69) and more than 3 hours of technology use (Median = 3.90), *U*=1158.00, *p*=.022. These results suggest that technology usage level significant effect on Practical Knowledge, Attitude to Association, and Total AI Awareness Score.

A cluster analysis was conducted to identify distinct groups among participants based on their AI awareness. Using K-means clustering, it was aimed to uncover underlying patterns in Practical Knowledge, Belief and Attitude, Attitude to Association, Theoretical Knowledge, and Total AI Awareness variables. Prior to clustering, all variables were standardized (z-score transformation) to place them on a common scale, minimizing the impact of differences in measurement units. To determine the optimal number of clusters, the Elbow Method was applied, performing a series of cluster analyses with cluster numbers ranging from 2 to 6. The within-cluster sum of squares (WCSS) values were plotted against each cluster solution, and the optimal number of clusters was identified at the point where the marginal decrease in WCSS began to diminish sharply, indicating that adding further clusters would yield minimal improvement (Everitt et al., 2011;

Kodinariya & Makwana, 2013). Consequently, k=3 was selected as it provided clear and meaningful separation of participant groups based on their responses to the AI awareness dimensions.

Table 10:
Mean Scores for AI Awareness Variables Across Clusters

Variable	Practical Knowledge	Beliefs and Attitude	Ability to Associate	Theoretical Information	Total AI Awareness
0	3.91	3.77	3.74	3.85	3.83
1	3.43	3.22	3.09	3.16	3.25
2	4.57	4.37	4.31	4.24	4.39

Table 10 provides a summary of mean scores for each AI-related variable within each cluster, indicating distinct AI awareness levels. Cluster 0 represents moderate awareness, Cluster 1 lower awareness, and Cluster 2 higher awareness. These clusters reveal diverse AI-related awareness levels among participants, providing a foundation for tailored educational approaches.

Cluster 0 was labeled as the Moderate Awareness Cluster, includes participants with moderate levels of Practical Knowledge (*M* = 3.91), Belief and Attitude (*M* = 3.77), Ability to Associate (*M* = 3.74), Theoretical Knowledge (*M* = 3.85), and AI Awareness Mean Score (*M* = 3.83). This group likely has a basic understanding and neutral or moderately positive attitudes toward AI.

Cluster 1 was labelled as the Lower Awareness Cluster, is characterized by generally lower scores across all variables, with Practical Knowledge (*M* = 3.43) and AI Awareness Mean Score (*M* = 3.25) being among the highest scores in this cluster. Participants in this group may have limited knowledge and relatively neutral attitudes toward AI.

Cluster 2 was labelled as the Higher Awareness Cluster across all AI-related variables, with Practical Knowledge (*M* = 4.57) and AI Awareness Mean Score (*M* = 4.39) being particularly high. This group reflects participants with strong knowledge and positive attitudes toward AI.

Conclusion

The study had two aims which are to determine the extent of awareness of AI among pre-service teachers and identify distinct awareness profiles, and to explore if these profiles are influenced by demographic factors suggested in the literature as relevant for technology-related learning. These findings provide insights into the diverse levels of AI awareness among pre-service teachers, which could inform targeted approaches in teacher education programs designed to build relevant AI skills.

The results indicated that technology usage had significant effect on AI awareness, while gender and academic department did not. There were significant differences in AI awareness based on technology usage, as higher use of these technologies was associated with increased AI awareness scores. Thus our data is paralleled with the work of Rainey et al. (2021) that greater familiarity with digital tools was a major determinant of positive attitudes toward AI. These findings are further supported by Nazaretsky et al. (2022), who suggested that a greater familiarization with technology can contribute to developing an understanding of AI and increase the self-efficacy towards adopting it in teaching practices. These results are particularly interesting because they contradict earlier findings that AI literacy might be associated with academic background (Walter 2024). Thus, despite differing from some previous literature, our results underscore the significance of technology familiarity as a foundational factor for AI literacy, suggesting that teacher education initiatives should focus primarily on practical technology usage rather than departmental differences. This highlights the need for teacher training to prioritize technological engagement over disciplinary backgrounds.

Cluster analysis identified three distinct AI awareness profiles among pre-service teachers: Moderate Awareness Cluster, Lower Awareness Cluster, and Higher Awareness Cluster. This clustering is consistent with previous studies showing varying levels of technological literacy among educators, with familiarity with AI varying widely even within similar years of education (Touretzky et al., 2019). The presence of these clusters suggests that AI literacy is not uniformly distributed among pre-service teachers. This shows a complex mix of personal experience, exposure, and comfort with AI technologies (BaHammam, 2023). Zhao et al. (2022) also noticed different knowledge levels in their study of in-service teachers. Compared to that, this study's results show a broad range of awareness profiles exists even during teacher training.

Cluster analysis was used to categorize participants into groups based on AI awareness providing insights into varying levels of knowledge and perspectives toward AI. This method allows for an in-depth understanding of distinct AI

awareness profiles, which can inform targeted educational strategies. These clusters highlight different levels of knowledge and perspectives on AI among participants.

- Cluster 0 (Moderate AI Awareness Cluster): This group has moderate scores across all dimensions, indicating neither low nor exceptionally high, meaning participants in this group have a moderate understanding toward AI. This group may have some exposure to AI but not as much depth as the high-scoring group.
- Cluster 1 (Lower AI Awareness Cluster): This group has lower scores across all dimensions, indicating limited knowledge or a more neutral/negative awareness toward AI. Participants here may be less engaged with AI concepts, potentially having less experience on it.
- Cluster 2 (Higher AI Awareness Cluster): This group scores high across all dimensions, indicating strong knowledge and positive attitudes toward AI. These participants are likely more familiar with AI concepts, possibly due to direct exposure to AI tools.

The AI awareness clusters identified provide actionable insights into AI literacy needs. As it was suggested by Walter (2024), who emphasized the importance of accessible, foundational AI content for beginners, the Lower Awareness Cluster could benefit from foundational AI literacy training, core AI concepts and more practical applications. The Moderate Awareness Cluster may benefit from intermediate-level instruction, focusing on ethical considerations and classroom-based AI applications. Finally, the Higher Awareness Cluster, which represents individuals with substantial knowledge and positive attitudes toward AI, could engage with advanced workshops exploring complex AI ethics, critical literacy, and the social implications of AI (Lee, 2024). Designing AI programs for these different groups is in line with the recommendation by Du (2024) that AI skills should be scaffolded according to individual levels of competence in order to achieve maximum learning.

This analysis reveals that AI awareness are not uniform across all participants. Instead, they fall into distinct levels, suggesting that people have varied levels of comfort, knowledge, and attitudes toward AI. This kind of insight can help in designing specific strategies to engage each group according to their current level of understanding.

Recommendations

In light of these findings, these are the Implications for Practitioners and Policy-Makers

1. Specialized AI training programs based on AI awareness levels: Policymakers who prepare teachers should advocate for specialized rather than generic AI literacy programs. Given the distinct AI awareness clusters identified among pre-service teachers, teacher preparation programs should offer differentiated AI literacy training tailored specifically to each group's current knowledge and attitudes. Introductory courses that cover AI core concepts and parameters may be necessary to increase baseline knowledge for pre-service teachers with less awareness, while those exhibiting intermediate or advanced awareness could benefit from advanced training, including complex applications, ethical considerations, and strategies for classroom integration. This approach provides level-based information to all pre-service teachers that addresses their needs and readiness levels.

2. Increased Technology Integration: Since departmental affiliation was not found to influence AI awareness significantly, educators and policymakers should focus less on disciplinary boundaries and more on universally encouraging technology-rich learning environments. Policies and initiatives should promote interdisciplinary technology integration, emphasizing universal digital competence and AI literacy among pre-service teachers, regardless of their academic specialization. Not surprisingly, familiarity with technology reflects a high level of awareness about AI and positive attitudes; therefore, teacher training programs should include more hands-on learning experience integrating AI technologies. This might result in better integration of AI-based tools in your curriculum, or having access to virtual environments representing how these new forms of intelligence work within educational scenarios.

3. Enhancing Practical Technology Engagement: Findings underscore that active technology usage significantly influences AI awareness. Therefore, teacher education curricula should prioritize extensive, hands-on engagement with technology, particularly emphasizing AI-based educational tools and platforms. Practitioners should integrate AI-driven instructional scenarios, simulations, and practical exercises within courses to foster meaningful technology experiences, thereby elevating pre-service teachers' familiarity and comfort with AI technologies.

Future Directions

Future research could further investigate the distinct clusters of AI awareness identified in this study, examining in greater detail how specific educational experiences, such as prior exposure to AI projects or different technology-based activities, shape pre-service teachers' knowledge and attitudes. Additionally, to validate these findings some more researches should be done in larger, more diverse samples within different educational contexts. Longitudinal studies could examine the long-term impact of differentiated AI literacy training on educators' integration of AI in the classroom and the resulting student outcomes. Overall, these targeted approaches will enable teacher education programs to prepare a workforce of AI-literate teachers that are equipped with the appropriate competencies for a new AI-driven educational contexts.

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Extended Abstract / Genişletilmiş Özet

Giriş

Yapay zeka (YZ), günümüzde problem çözme, karar verme ve dijital sistemlerin paradigmalarını değiştirmeye başlayan bir teknolojik devrimdir. YZ okuryazarlığı, toplumun tüm üyeleri için temel bir hak haline gelmektedir. Eğitim alanında YZ'nin kullanımı giderek artmakta ve öğrenme deneyimlerinin kişiselleştirilmesi, öğrenci katılımının artırılması ve daha büyük idari verimlilik sağlaması beklenmektedir. YZ'nin eğitim teknolojisi operasyonlarında önemli bir rol oynaması ve eğitimcilerin bu alanda yetkin olması beklenmektedir.

YZ farkındalığı, sadece YZ teriminin bilinmesiyle sınırlı değildir; prosedürel bilgi, inançlar, ilişkisel beceriler ve teorik bilgileri içeren çok yönlü bir yapıdır. Etik konular, yapay sistemlerin yanlılığı ve toplumsal sonuçlar hakkında bilgi sahibi olmayı da içerir. YZ okuryazarlığı, YZ'nin toplum üzerindeki potansiyel etkisi, YZ öğrenmedeki öz-yeterlik ve YZ etiği farkındalığını da kapsar. Öğretmen eğitiminde, YZ araçlarını eğitim ortamlarında uygun şekilde kullanabilmeleri için YZ teknolojilerini eleştirel olarak değerlendirme ve YZ ile başarılı bir şekilde iletişim kurma ve işbirliği yapma becerisine sahip olmaları gerekmektedir.

Bu çalışma, Mersin Üniversitesi'ndeki öğretmen adaylarının YZ farkındalık düzeylerini ve bu farkındalık profillerinin demografik faktörlerden etkilenip etkilenmediğini incelemeyi amaçlamaktadır. Ayrıca, öğretmen adaylarının YZ farkındalık düzeylerine bağlı olarak bir kümeleme analizi de yapılmıştır. Çalışma, öğretmen yetiştirme programlarının geliştirilmesine ve eğitimcilerin YZ destekli sınıflara hazırlanmasına yönelik süreçlerin planlanmasına katkıda bulunmayı hedeflemektedir.

Yöntem

Araştırma Modeli

Bu çalışma, Mersin Üniversitesi'ndeki öğretmen adaylarının YZ farkındalık düzeylerini araştırmak için nicel bir araştırma tasarımı kullanmıştır. Betimsel tarama modelinde, mevcut durumu olduğu gibi tanımlamayı amaçlar ve genellikle bireylerin görüşleri, tutumları, davranışları veya özellikleri hakkında bilgi toplamak için kullanılır. Bu çalışmada, çeşitli demografik değişkenlerin üniversite öğrencilerinin YZ farkındalığı ve ilgili alt ölçekleri üzerindeki etkileri incelenmiştir. Hedef kitle, 2023-2024 akademik yılı boyunca Eğitim Fakültesi'ndeki çeşitli öğretmen yetiştirme programlarına kayıtlı öğretmen adaylarından oluşmaktadır.

Örneklem ve Katılımcılar

Çalışmaya katılımcıları dahil etmek için uygun örnekleme yöntemi kullanılmıştır. Öğretmen adayları, e-posta ve sosyal medya platformları aracılığıyla dağıtılan çevrimiçi bir form aracılığıyla gönüllü olarak katılmaya davet edilmiştir. Toplam 117 öğretmen adayı çalışmaya katılmıştır.

Veri Toplama Araçları

Veriler, iki araç kullanılarak toplanmıştır: demografik bilgi formu ve Ferikoğlu ve Akgün (2022) tarafından geliştirilen Öğretmenler için YZ Farkındalık Ölçeği. Demografik form, katılımcıların yaşı, cinsiyeti, bölümü, genel not ortalaması, önceki YZ ile ilgili ders deneyimleri, teknoloji kullanımı ve internet kullanımı hakkında bilgi toplamıştır. Öğretmenler için YZ Farkındalık Ölçeği, öğretmenlerin YZ farkındalık düzeylerini dört boyutta ölçen, geçerli ve güvenilir bir ölçektir: Pratik bilgi, inançlar ve tutumlar, ilişkilendirme yeteneği ve teorik bilgi. Ferikoğlu ve Akgün (2022), genel ölçek için iyi bir iç tutarlılık bildirmiştir ($\alpha = 0.98$).

Bu çalışma, Mersin Üniversitesi Sosyal ve Beşeri Bilimler Etik Kurulu'ndan 15/03/2024 tarihli ve 112 sayılı kararı ile araştırma verilerinin toplanmasının etik açıdan uygun olduğuna dair uygulama izni alınarak gerçekleştirilmiştir.

Veri Analizi

Eğitim fakültesi öğrencilerinin genel YZ farkındalık düzeylerini ve alt ölçeklerdeki puanlarını belirlemek için ortalamalar ve standart sapmalar dahil olmak üzere tanımlayıcı istatistikler hesaplanmıştır. Demografik değişkenler cinsiyet, akademik bölüm ve teknoloji kullanımına dayalı olarak YZ farkındalık düzeylerindeki potansiyel farklılıkları incelemek için bağımsız örneklem t-testleri ve tek yönlü varyans analizi (ANOVA) yapılmıştır. Normal dağılmayan veriler için veya varyansların homojenliği varsayımları karşılanmadığında, Mann-Whitney U testi kullanılmıştır. Katılımcılar arasında YZ farkındalık puanlarına ve alt ölçeklerine göre farklı grupları belirlemek için K-ortalamalar algoritmasını kullanan kümeleme analizi de yapılmıştır. Bu analiz, katılımcılar arasında değişen YZ farkındalığı modellerini keşfetmeyi amaçlamıştır.

Bulgular

Bu çalışmanın amacı, öğretmen adaylarının YZ farkındalığını belirlemek ve farklı farkındalık profillerini belirlemektir. YZ farkındalığının öğrenme için önemli olduğu öne sürülen demografik faktörlerden etkilenip etkilenmediğini keşfetmektir. Analiz, cinsiyet, akademik bölüm ve teknoloji kullanımı gibi demografik kategoriler arasında YZ farkındalık puanlarını karşılaştırmak için gerçekleştirilmiştir. Bazı demografik faktörlerin YZ farkındalığını nasıl etkileyebileceği hakkında anahtar niteliğindedir, böylece YZ'yi öğretim uygulamalarına entegre etmek için gereken yetkinliklere ve uzmanlığa sahip geleceğin eğitimcilerini şekillendirmek için açıkça hedeflenmiş stratejiler belirlenebilir. Ayrıca, katılımcıların YZ farkındalığı ve tutumlarına göre örneklem içindeki farklı grupları belirlemek için Kümeleme analizi yapılmış ve böylece YZ'ye yönelik değişen bilgi ve algı düzeylerinin daha derinlemesine anlaşılması sağlanmıştır. Aşağıdaki bölümler, bu analizlerden elde edilen istatistiksel bulguları ayrıntılı olarak ele alarak, demografik farklılıkların öğretmen adayları arasında YZ farkındalık düzeylerini nasıl şekillendirebileceği konusunda fikir vermektedir.

Cinsiyete Göre YZ Farkındalığı

Cinsiyetin YZ farkındalığı üzerinde anlamlı bir etkisi olmadığı tespit edilmiştir (Tablo 7). Erkek ve kadın öğretmen adayları arasında Pratik Bilgi, İnançlar ve Tutumlar, İlişkilendirme Yeteneği, Teorik Bilgi ve Toplam YZ Farkındalığı puanlarında anlamlı bir fark bulunmamıştır.

Bölüme Göre YZ Farkındalığı

Bölümün YZ farkındalığı üzerinde anlamlı bir etkisi olmadığı tespit edilmiştir (Tablo 8). Farklı bölümlerdeki öğretmen adayları arasında Pratik Bilgi, İnançlar ve Tutumlar, İlişkilendirme Yeteneği, Teorik Bilgi ve Toplam YZ Farkındalığı puanlarında anlamlı bir fark bulunmamıştır.

Teknoloji Kullanımına Göre YZ Farkındalığı

Teknoloji kullanımının YZ farkındalığı üzerinde anlamlı bir etkisi olduğu tespit edilmiştir (Tablo 9). Daha fazla teknoloji kullanan öğretmen adaylarının, daha az teknoloji kullananlara kıyasla Pratik Bilgi, İlişkilendirme Yeteneği ve Toplam YZ Farkındalığı puanlarında anlamlı derecede daha yüksek olduğu bulunmuştur.

Kümeleme Analizi

Katılımcılar arasında YZ farkındalığına dayalı olarak farklı grupları belirlemek için kümeleme analizi yapılmıştır. K-ortalamalar kümelemesi kullanılarak, Pratik Bilgi, İnançlar ve Tutumlar, İlişkilendirme Yeteneği, Teorik Bilgi ve Toplam YZ Farkındalığı değişkenlerindeki temel kalıpları ortaya çıkarmak amaçlanmıştır. Kümelemeden önce, tüm değişkenler, ölçüm birimlerindeki farklılıkların etkisini en aza indirmek için ortak bir ölçekte yerleştirmek üzere standartlaştırılmıştır (z-puanı dönüşümü). Optimum küme sayısı, azalan getiri noktasının veriler için uygun bir küme sayısını gösterdiği Dirsek Yöntemi kullanılarak belirlenmiştir. K-ortalamalar kümelemesi, seçilen küme sayısı olarak k=3 ile gerçekleştirilmiş ve her küme, katılımcıların yanıtlarına göre benzersiz bir gruplamayı temsil etmektedir.

Üç farklı YZ farkındalığı profili belirlenmiştir: Orta Düzey Farkındalık Kümesi, Düşük Düzey Farkındalık Kümesi ve Yüksek Düzey Farkındalık Kümesi (Tablo 10). Bu kümeler, katılımcılar arasında farklı YZ ile ilgili farkındalık düzeylerini ortaya koymakta ve uyarlanmış eğitim yaklaşımları için bir temel sağlamaktadır.

- **Orta Düzey Farkındalık Kümesi:** Bu küme, tüm boyutlarda orta düzeyde puanlara sahip katılımcıları içerir ve YZ'ye karşı ılımlı bir anlayışa sahip olduklarını gösterir.
- **Düşük Düzey Farkındalık Kümesi:** Bu küme, tüm boyutlarda genellikle düşük puanlarla karakterize edilir ve YZ hakkında sınırlı bilgiye veya daha tarafsız/olumsuz bir farkındalığa sahip olduklarını gösterir.
- **Yüksek Düzey Farkındalık Kümesi:** Bu küme, tüm YZ ile ilgili değişkenlerde yüksek puanlar alır ve YZ hakkında güçlü bilgi ve olumlu tutumlara sahip olduklarını yansıtır.

Tartışma ve Sonuç

Bu çalışma, öğretmen adayları arasında YZ farkındalığının ve tutumlarının çeşitliliğini ortaya koymuştur. Teknoloji kullanımı, YZ farkındalığını önemli ölçüde etkilerken, cinsiyet ve akademik bölümün anlamlı bir etkisi olmadığı bulunmuştur. Bu bulgular, daha fazla dijital araçlara aşinalığın YZ'ye yönelik olumlu tutumların önemli bir belirleyicisi olduğunu gösteren Rainey ve arkadaşlarının (2021) çalışmasıyla paralellik göstermektedir. Bu bulgular, teknolojiye daha fazla aşinalığın YZ anlayışının geliştirilmesine ve öğretim uygulamalarında benimsenmesine yönelik öz-yeterliğin artmasına katkıda bulunabileceğini öne süren Nazaretsky ve arkadaşları (2022) tarafından da desteklenmektedir. Bu sonuçlar özellikle ilginçtir çünkü YZ okuryazarlığının akademik geçmişle ilişkili olabileceği yönündeki önceki bulgularla çelişmektedir (Walter 2024). Bununla birlikte, YZ okuryazarlığı üzerinde herhangi bir bölüm etkisi tespit edilememesi, teknolojiyle çalışmanın, bir öğrencinin hangi disiplini seçtiğinden daha önemli olduğunu göstermektedir.

Kümeleme analizi, öğretmen adayları arasında üç farklı YZ farkındalığı profili ortaya koymuştur: Orta Düzey Farkındalık Kümesi, Düşük Düzey Farkındalık Kümesi ve Yüksek Düzey Farkındalık Kümesi. Bu kümeleme, eğitimciler arasında değişen teknoloji okuryazarlığı düzeylerini gösteren önceki çalışmalarla tutarlıdır; YZ'ye aşinalık, benzer eğitim yılları içinde bile büyük farklılıklar göstermektedir (Touretzky ve arkadaşları, 2019). Bu kümelerin varlığı, YZ okuryazarlığının öğretmen adayları arasında eşit olarak dağılmadığını göstermektedir. Bu, kişisel deneyim, maruz kalma ve YZ teknolojileriyle rahatlık arasında karmaşık bir karışımı göstermektedir (BaHammam, 2023). Zhao ve arkadaşları (2022), hizmet içi öğretmenler üzerinde yaptıkları çalışmada da farklı bilgi düzeyleri fark etmişlerdir. Buna kıyasla, bu çalışmanın sonuçları, öğretmen eğitimi sırasında bile geniş bir farkındalık profili yelpazesinin olduğunu göstermektedir.

Kümeleme analizi, katılımcıları YZ farkındalığına göre gruplara ayırmak için kullanılmış ve böylece YZ'ye yönelik değişen bilgi ve bakış açıları düzeylerine dair fikir edinmemizi sağlanmıştır. Bu yöntem, hedeflenen eğitim stratejileri hakkında bilgi verebilecek farklı YZ farkındalığı profillerinin derinlemesine anlaşılmasını sağlar.

Belirlenen YZ farkındalığı kümeleri, YZ okuryazarlığı ihtiyaçlarına ilişkin eyleme geçirilebilir bilgiler sağlar. Yeni başlayanlar için erişilebilir, temel YZ içeriğinin önemini vurgulayan Walter (2024) tarafından önerildiği gibi, Düşük Farkındalık Kümesi, temel YZ okuryazarlığı eğitimi, temel YZ kavramları ve daha pratik uygulamalardan yararlanabilir. Orta Düzey Farkındalık Kümesi, etik hususlara ve sınıfta YZ uygulamalarına odaklanan orta düzey talimatlardan yararlanabilir. Son olarak, YZ hakkında önemli bilgiye ve olumlu tutumlara sahip bireyleri temsil eden Yüksek Farkındalık Kümesi, karmaşık YZ etiğini, eleştirel okuryazarlığı ve YZ'nin toplumsal etkilerini araştıran ileri düzey atölye çalışmalarına katılabilir (Lee, 2024). Bu farklı gruplar için YZ programları tasarımı, maksimum öğrenmeyi sağlamak için YZ becerilerinin bireysel yetkinlik düzeylerine göre kademelendirilmesi gerektiği yönündeki Du (2024) tarafından yapılan tavsiyeyle uyumludur.

Bu analiz, YZ farkındalığının tüm katılımcılar arasında tek tip olmadığını ortaya koymaktadır. Bunun yerine, farklı düzeylere ayrılırlar ve bu da insanların YZ'ye karşı farklı düzeylerde rahatlık, bilgi ve tutumlara sahip olduğunu gösterir. Bu tür bir içgörü, her grubu mevcut anlayış düzeylerine göre etkileşime sokmak için belirli stratejiler tasarlamakta yardımcı olabilir.

Uygulayıcılar ve Politika Yapıcılar için Öneriler:

Bu çalışmanın bulguları, öğretmen adaylarının YZ farkındalık düzeylerine göre farklılaştırılmış eğitim politikaları ve uygulamalarının geliştirilmesi gerektiğini göstermektedir. Bu bağlamda aşağıdaki öneriler geliştirilebilir:

Özelleştirilmiş YZ eğitimi programları: Çalışmada tespit edilen farklı YZ farkındalık profilleri, öğretmen adaylarına yönelik genel geçer değil, farklı düzeylere hitap eden özel eğitim içeriklerinin gerekliliğine işaret etmektedir. Düşük farkındalık düzeyine sahip öğretmen adayları için YZ'nin temel kavramlarını ve işleyişini açıklayan giriş düzeyinde kurslar sunulmalıdır. Orta ve ileri düzey farkındalığa sahip bireyler ise, YZ'nin eğitimdeki etik boyutları, gelişmiş uygulama örnekleri ve sınıf içi entegrasyonu gibi ileri içeriklerle desteklenmelidir. Böylece öğretmen adaylarının bilgi düzeyleri ve tutumlarına uygun, ihtiyaç temelli bir eğitim yaklaşımı benimsenmiş olur.

Artan Teknoloji Entegrasyonu: Araştırma sonuçlarına göre öğretmen adaylarının bağlı bulundukları akademik bölüm, YZ farkındalığı üzerinde anlamlı bir etkide bulunmamaktadır. Bu durum, YZ okuryazarlığı ve dijital yeterliklerin tüm öğretmen adayları için disiplinlerüstü bir şekilde ele alınması gerektiğini göstermektedir. Öğretmen yetiştirme programları, sadece belirli bölümlerle sınırlı kalmadan tüm öğretmen adaylarının teknolojiye erişimini ve teknolojiyi etkin kullanma becerilerini geliştirmeyi hedeflemelidir. Bu doğrultuda, YZ ile desteklenen sanal ortamlar, etkileşimli uygulamalar ve teknoloji odaklı öğretim senaryoları programlara entegre edilmelidir.

Uygulamalı Teknoloji Kullanımı Odaklı Öğrenme Deneyimleri Artırılmalıdır: Çalışma bulguları, aktif teknoloji kullanımının öğretmen adaylarının YZ farkındalık düzeyini artırdığını göstermektedir. Bu nedenle öğretmen eğitimi programları, kuramsal bilgilerin yanında uygulamalı içeriklere de yer vermelidir. Yapay zekâ destekli araçlar, simülasyonlar, senaryolar ve gerçek dünya uygulamaları yoluyla öğretmen adaylarının YZ teknolojileriyle etkileşimi artırılmalı; bu da onların teknolojiyi sınıf ortamına taşıma konusunda güven ve yeterlilik kazanmalarına katkı sağlayacaktır.

Bu kümeler öğretmenler hakkında daha fazla ve daha iyi uyarlanmış YZ eğitimleri geliştirmek için katkı sağlayabilir. Ayrıca, bu bulguları doğrulamak için farklı eğitim bağlamlarında daha büyük ve daha çeşitli örneklerle daha fazla araştırma yapılmalıdır. Genel olarak, bu hedefli yaklaşımlar, öğretmen yetiştirme programlarının, yeni YZ odaklı bir eğitim bağlamı için uygun yetkinliklerle donatılmış YZ okuryazarı öğretmenlerden oluşan bir iş gücü hazırlamasını sağlayacaktır.