Experimental Perspective on Artificial Intelligence Anxiety

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Article Info	Abstract
	The aim of this study was to determine the effect of training on the integration of artificial intelligence into education given to pre-service teachers on their concerns about artificial intelligence and their views on the integration of artificial intelligence into education. In this study, sequential explanatory design, one of the mixed research designs, was preferred. In the quantitative part of the research, single group quasi-experimental research design was used. In the qualitative part of the study, a basic qualitative research design was used. In the experimental process, a four-week artificial intelligence training program was administered to pre-service teachers for three hours a week. The study group consisted of 195 pre-service teachers. Data were collected using the artificial intelligence anxiety scale and a semi-structured interview form. The data obtained were analyzed using t, MANCOVA, and content analysis methods, and the following results were obtained: The training on the integration of artificial intelligence into education decreased pre-service teachers' anxiety in the learning dimension but increased their anxiety in other dimensions. The main sources of anxiety are inequality, ethics, privacy, and reliability, professional and social anxiety, unpredictable decisions and loss of control, technology use and adaptation difficulties, artificial intelligence addiction, and decreased creativity.

Introduction

Artificial intelligence (AI) technology will become more widespread in the future and will be used more in many areas of our lives. This makes the process of people's acceptance and use of AI more important. Although AI technology has great potential in many areas, it may also pose some challenges in the process of human acceptance and use. AI plays an important role in today's technological era. The ability of computers and machines to think like humans is creating a major change in many fields. With applications ranging from agriculture to space sciences, it is a transformative force in today's digital age (Duraipandian, 2022). It is reshaping education through personalized learning (Panigrahi, 2020). The potential for AI to outperform humans in complex tasks is a double-edged sword with potential benefits in disease prevention and poverty alleviation, but it also poses ethical challenges (Poola, 2017).

With the increasing use of technology, concerns about technology are also increasing among people (Zaineldeen et al., 2020). Concerns about the security of personal data are common. Risks such as cyber-attacks and fraud are potential problems that people experience with the use of technology (Wang et al., 2022). Therefore, with the

rapid development of technology, people's anxiety about technology also increases (Dhagarra et al., 2020). However, some aspects of technology can also help reduce anxiety. For example, through remote communication possibilities, people can stay in touch with their loved ones, thus reducing anxiety levels by maintaining social ties (Wang et al., 2022). Furthermore, technology tools can also be used to improve people's quality of life. For example, health technologies can help patients keep track of their health more easily and effectively, which can reduce their anxiety about their health. (Rajak & Shaw, 2021). With the rapid advancement of technology, people's dependence on technology is increasing, which affects their anxiety levels. However, when technology is used in the right way, it can make people's lives easier and reduce their anxiety levels. Therefore, it is important to understand and manage the relationship between technology use and anxiety (Sagnier et al., 2020).

AI is a technology that is developing at a tremendous pace and is increasingly becoming a part of our daily lives. However, concerns about this technology are growing at the same rate. Concerns such as the potential of AI to cause addiction in humans, the risk of job loss, and unemployment considerably increase anxiety levels (Wang et al., 2022). In addition, the potential for AI to intensify social isolation and privacy concerns is a growing area of concern (Aygün, 2023; Elmalıca, 2016). Ethical concerns and security issues surrounding the use of AI have become a major source of concern for humans. These concerns are particularly evident in the context of international law, where the use of AI in autonomous weapons and content personalization poses a threat to human rights (Dost, 2023). Therefore, a great deal of emphasis should be placed on empirical studies to understand the relationship between AI and anxiety. These studies can help us fully grasp the potential risks and negative effects of AI. For all these reasons, AI, and the anxieties it brings with it should be studied in more detail.

While artificial intelligence offers many opportunities in the field of education, it also raises some concerns. The potential for AI to replace teachers and create unemployment is a major concern (Korinek, 2017; Maity, 2022). While some researchers argue that AI can boost existing jobs (Tschang, 2020), others warn of the possibility of widespread unemployment (Ford, 2013; Bruun, 2018). The potential of AI in education is a much-debated topic, with some arguing that AI can never fully replace human teachers because of its unique qualities (Chan 2023, Cope et al., 2020). Every student has a different learning pace and learning style, and it can be quite challenging for AI to respond appropriately to these differences. Important factors such as individualized instruction, student-specific learning materials, and goal orientation can push AI to its limits. Ensuring that each student progresses at their own pace and providing them with a learning experience that is just right for them is an obstacle that AI will need to overcome. Another concern is that AI raises privacy and security issues. Concerns such as how student data will be stored, who will have access to it, and how it will be protected are important factors that limit the integration of AI into education (Huang, 2023). The possibility of students' personal information falling into the hands of malicious people or being used for unwanted purposes creates a major trust issue among educational institutions, parents, and students. These concerns are serious obstacles to the integration of AI into education. However, various solutions are being explored to address these issues and adapt AI to the educational process. An education system in which both human teachers and AI work together can provide students with a better learning experience and improve the quality of education. Therefore, it is of great importance to develop the appropriate methods and policies to use the positive contributions of AI while addressing the issues of concern.

As a result, it is possible to say that it is normal for people to have high anxiety about unfamiliar technologies. In this direction, it is thought that teachers' gaining enough experience on how to integrate AI technologies into educational processes in a correct and effective way can reduce pre-service teachers' anxiety toward AI by positively affecting the perceived ease of use and perceived benefit within the framework of the technology acceptance model. In this framework, this study aimed to determine the effect of training on the integration of artificial intelligence into education on pre-service teachers' anxiety toward AI and their views on the integration of artificial intelligence into education. In the literature, there is evidence that gender and department variables are effective on many variables such as pre-service teachers' technological competencies, internet, social media, etc. addiction levels, and their perceptions toward technology. Therefore, it was found appropriate to address gender and department variables within the scope of the study. In this direction, answers the following subproblems were sought:

1. Does training on the integration of artificial intelligence into education affect pre-service teachers' anxiety about artificial intelligence?
2. Does training on the integration of artificial intelligence into education affect pre-service teachers' anxiety toward artificial intelligence, depending on gender?
3. Depending on the departments, is there an effect of training on the integration of artificial intelligence into education on pre-service teachers' anxiety toward artificial intelligence?
4. What are the sources of pre-service teachers' concerns about artificial intelligence?
5. What are the expectations of prospective teachers regarding artificial intelligence?
6. What do prospective teachers think about the contributions of artificial intelligence?

Method

Research Design

In this study, sequential explanatory design, one of the mixed research designs, was preferred. A sequential explanatory design is a design in which quantitative and qualitative research models are used together. In the research process, the QUANTITATIVE → QUALITATIVE model was used. In the quantitative part of this study, a pretest– posttest without control group quasi-experimental research design was used. In the qualitative part of the study, a basic qualitative research design was used. In this framework, a semi-structured interview form consisting of five questions is used.

Study Group

The convenience sampling method, which is a nonrandomized method, was used to form the study group for the quantitative dimension of this research. In this context, 195 pre-service teachers who are studying in the first year at a university Faculty of Education in Central Anatolia and taking the Information Technologies course and studying in the PDF, Classroom Teaching, Social Studies Teaching, and Science Teaching departments where the researcher teaches as an instructor constitute the study group of this research. The distribution of the study group by department and gender is summarized in Table 1.

Table 1. Distribution of the Study Group by Gender and Department

		Gender		
		Woman	**Male**	**Total**
Section	**PDR**	38	22	60
	Social Studies Teacher	37	19	56
	Classroom Teacher	32	18	50
	Science Teacher	19	10	29
Total		126	69	195

For the qualitative dimension of the study, the study group consisted of 48 students who were willing to participate in the semi-structured process on a voluntary basis.

Data Collection Tools

Artificial Intelligence Anxiety Scale

The Artificial intelligence anxiety scale, originally developed by Wang and Wang (2019) and adapted into Turkish by Akkaya, Özkan, and Özkan (2021), consists of 16 items and four factors. There are five items in the factor named Learning, three items in the factor named AI Configuration, four items in the factor named Job change, and four items in the factor named Sociotechnical blindness. To test the construct validity of the scale, exploratory factor analysis was conducted in the first stage. According to the results of the exploratory factor analysis, the factors together explain 76.9% of the total variance. Because of the confirmatory factor analysis conducted in the second stage, the goodness's of fit values were $\Delta\chi^2$ = 260.120, sd= 99 χ^2/sd=2.627, NFI=.923, CFI=.950, RFI=.906, IFI=.951, TLI=.940, RMSEA= .078, p=.000. The Cronbach alpha internal consistency coefficient of the scale was 0.937; the internal consistency coefficients for the factors ranged between 0.950 and 0.875.

Semi-Structured Interview Form

A semi-structured interview form consisting of four questions was created by the researchers to determine the source of pre-service teachers' concerns about AI, their expectations, and their thoughts about the contributions of AI. The interview form was examined by two faculty members who are experts in the field of educational technology, and necessary corrections were made.

Experimental Process

Four-weeks, three-hours per week artificial intelligence training program was planned for pre-service teachers, focusing on a different area of artificial intelligence technologies each week. This comprehensive program enables pre-service teachers to explore how they can integrate technological tools into their learning processes and how they can enrich students' educational experiences.

The first week focused on the basics of text processing and natural language processing (NLP). The aim was to

improve pre-service teachers' ability to analyze and interpret text-based data. The functionality and applicability of interactive learning tools, such as chatbots and in-class feedback systems, were emphasized, and the candidates experienced how these tools can be used in education. Details of the courses are presented in Appendix.

At the end of each week, pre-service teachers were encouraged to consolidate and apply what they had learned through concrete projects, thus ensuring an interactive and participatory training experience. With the completion of the training series, pre-service teachers will gain the skills to use AI technologies in their classrooms in conscious and creative ways.

Data Analysis

To determine whether parametric tests can be used in the analysis of the data for the quantitative dimension of the study, the Kolmogorov– Smirnov test was applied to determine whether the collected data showed a normal distribution. The results are summarized in Table 2.

Table 2. Normality Test of the Data

		Statistics	SD	p	Skewness	kurtosis
F1: Learning	Pretest	0.164		0.000	0.630	0.698
	Posttest	0.157		0.000	0.269	-0.615
F2: Job Change	Pretest	0.123		0.000	-0.485	-0.587
	Posttest	0.183		0.000	-0.578	1.031
F3: Sociotechnical Blindness	Pretest	0.162	195	0.000	-0.685	-0.470
	Posttest	0.182		0.000	-0.405	0.882
F4: AI Configuration	Pretest	0.151		0.000	-0.069	-1.106
	Posttest	0.208		0.000	-0.005	-0.352
Artificial intelligence anxiety	Pretest	0.099		0.000	-0.595	-0.076
	Posttest	0.109		0.000	-0.172	-0.476

According to the Kolmogorov– Smirnov test results, it was determined that the distribution of both the total score and factor scores of AI anxiety was not normal ($p<0.05$). However, when the kurtosis and skewness coefficients for total and factor scores are examined, these values are between +1.50 and -1.50. According to Büyüköztürk et al. (2008), scales with skewness coefficients between +1.50 and -1.50 are assumed to be normally distributed. In this framework, it was decided that parametric analyses could be performed on the collected data. In the analysis of the data, it was decided to use the mean, standard deviation, independent sample t-test, and MANCOVA test. The assumptions that must be met to use the MANCOVA test can be summarized as follows:

- *Variables*: Although there is no dependent variable other than artificial intelligence anxiety within the scope of the research, this variable has four factors, and each factor is considered as a dependent variable.
- *Independent variables with two or more groups:* Gender and department were determined as

independent variables within the scope of the research, and both were variables with two or more groups.

- *Observations should be independent:* Each student was in only one group. Necessary precautions were taken to prevent participants from interacting with each other while answering the scale.
- *Sample size should be sufficient:* The sample size should be at least 30 in each group. However, it is explained in the literature that this number can be taken up to 20 (Büyüköztürk et al., 2008). The number of students in all groups within the scope of the study was 29 or above.
- *There should be no univariate or multivariate outliers*: The Mahalanobis Distance test was used to investigate whether there were outliers in the gender and department independent variables and pretest and posttest scores obtained within the scope of the research. The collected data met this assumption (Mahal. Distance = min: 0.603, max: 4.649).
- *Multiple normal distribution of data:* As summarized in Table 2, the collected pretest and posttest data were normally distributed. In addition, the multiple normality of the groups formed according to gender and departments was also examined, and it was observed that the data were also normally distributed.
- *Multicollinearity: The* relationship between factor and total scores in terms of both pre-test and post-test was investigated by Pearson's r correlation, and it was determined that there was a significant linear relationship between all factors and total scores between 0.305 and 0.893 ($p < 0.01$).
- *Homogeneity of Regressions***:** When the Scotterplot drawn for the variables is analyzed, it is determined that there is a linear relationship, and the regressions are homogeneous**.**
- *Equality of within-group regression coefficients:* When the interactional effects of gender, department, and factors were analyzed, it was determined that the significance values were greater than 0.05. Accordingly, the within-group regression coefficients were found to be equal.
- *Homogeneity of variance– covariance matrices:* because of the Box's test for each factor, since the significance level was greater than 0.05, it was determined that the condition of homogeneity of variances was met. In addition, Levene's test was examined, and it was determined that the variances were equal in terms of both departments and gender.

The data collected for the qualitative dimension of the study were analyzed by content analysis using NVIVO.

Findings

Effect of training for integrating artificial intelligence into education on pre-service teachers' anxiety toward artificial intelligence

The findings regarding the effect of training on the integration of artificial intelligence into education and pre-service teachers' concerns about artificial intelligence are summarized in Table 3. When Table 3 is examined in terms of the learning factor, it is seen that the training on the integration of AI into education significantly differentiated the students' AI anxiety [$t_{(194)} = 17.290$, $p < 0.01$]. While the average of the total anxiety scores of pre-service teachers was $\bar{X} = 10.7$ before the application, it decreased to $\bar{X} = 7.4$ after the application. When examined in terms of the job change factor, it is seen that training on the integration of artificial intelligence into

education significantly differentiated students' anxiety about artificial intelligence [$t_{(194)}$ =-15.131, p<0.01]. While the average of pre-service teachers' anxiety total scores was $\bar{X}$ =13.1 before the implementation, it increased to $\bar{X}$ =17.8 after the implementation. When analyzed in terms of the sociotechnical blindness factor, it is seen that training on the integration of artificial intelligence into education significantly differentiated students' anxiety about artificial intelligence [$t_{(194)}$ =-13.836, p<0.01]. While the average of pre-service teachers' anxiety total scores was $\bar{X}$ =12.9 before the implementation, it increased to $\bar{X}$ =17.5 after the implementation. When examined in terms of the artificial intelligence configuration factor, it is seen that training on the integration of artificial intelligence into education significantly differentiated students' artificial intelligence anxiety [$t_{(194)}$ =-15.214, p<0.01]. While the average of the total anxiety scores of pre-service teachers before the application was $\bar{x}$ =8.9, it increased to $\bar{X}$ =12.9 after the application. It is also seen that the effect size is large. According to this, while training for the integration of artificial intelligence into education decreased the anxiety of pre-service teachers in the learning dimension, it caused an increase in their anxiety in terms of other dimensions.

Table 3. Effect of Training on the Integration of Artificial Intelligence into Education on Anxiety

Dependent Variables		$\bar{X}$	n	sd.	t	df	p	$\acute{\eta}^2$
F1: Learning	Pretest	10.68		3.64	17.290	194	0.000	0.61
	Posttest	7.41		1.64				
F2: Job Change	Pretest	13.05		4.44	-15.131		0.000	0.54
	Posttest	17.78	195	1.23				
F3: Sociotechnical Blindness	Pretest	12.99		4.29	-13.836		0.000	0.50
	Posttest	17.45		1.09				
F4: AI Configuration	Pretest	8.97		3.71	-15.214		0.000	0.54
	Posttest	12.96		.932				

The adjusted posttest means scores of pre-service teachers' anxiety toward artificial intelligence according to their pre-test scores after the training on the integration of artificial intelligence into education, depending on gender, are given in Table 4.

Table 4. Artificial Intelligence Anxiety Score and Corrected Score Averages of the Groups After Application according to Gender

Dependent Variables			Pretest		Posttest		Adjusted Average	
		n	$\bar{X}$	sd.	$\bar{X}$	sd.	$\bar{X}$	SE
F1: Learning	Woman	126	10.30	3.52	7.24	1.59	7.36	.097
	Male	69	11.37	3.76	7.71	1.69	7.49	.132
F2: Job Change	Woman	126	13.05	4.43	17.72	1.30	17.73	.109
	Male	69	13.05	4.48	17.91	1.08	17.90	.149
F3: Sociotechnical Blindness	Woman	126	13.03	4.39	17.50	1.13	17.51	.098
	Male	69	12.92	4.13	17.34	1.02	17.34	.134
F4: AI Configuration	Woman	126	9.17	3.71	13.03	0.94	12.02	.083
	Male	69	8.62	3.72	12.84	0.90	12.85	.113

As shown in Table 4, the mean post-test scores adjusted according to the pre-test scores of AI anxiety for the learning factor were 7.1 for female pre-service teachers and 7.3 for male pre-service teachers; the mean post-test scores adjusted according to the pre-test scores of the job change factor were 17.7 for female pre-service teachers and 17.8 for male pre-service teachers; the mean post-test scores adjusted for the pre-test scores of the sociotechnical blindness factor were found to be 17.5 for both female and male pre-service teachers; the mean post-test scores adjusted for the pre-test scores of the factor of constructivism were found to be 12.9 for female pre-service teachers and 12.8 for male pre-service teachers. When the pre-tests were controlled, the MANCOVA results regarding the difference in post-test scores according to the gender covariate are summarized in Table 5.

Table 5. Effect of Training on Integration of Artificial Intelligence into Education on Anxiety based on Gender

Impact	Wilks' lambdas	F	Hip. SD	Error sd.	P	$\acute{\eta}^2$	Observed Power
Gender	.982	0.891	4	186	0.471	0.019	0.280

As seen in Table 5, when the pre-tests were taken under control, it was determined that there was no significant difference in the post-tests in terms of gender ($F_{(4,186)} = 0.891$, p>0.000). Accordingly, it can be said that the change caused by the training on the integration of artificial intelligence into education in pre-service teachers' anxiety toward artificial intelligence does not differ according to gender. Table 6 shows the post-test mean scores of the pre-service teachers' anxiety toward artificial intelligence adjusted according to their pre-test scores after the training on the integration of artificial intelligence into education, depending on the department.

Table 6. Artificial Intelligence Anxiety Score and Corrected Score Averages of the Groups after Application by Department

Dependent Variables	Measurement		Pretest		Posttest		Adjusted Average	
		n	$\bar{X}$	sd.	$\bar{X}$	sd.	$\bar{X}$	SE
F1: Learning	PDR	60	10.70	3.54	7.66	1.87	7.64	.139
	Social Science	56	10.80	3.98	7.16	1.61	7.16	.145
	Classroom	50	10.82	3.50	7.46	1.41	7.38	.153
	Science	29	10.17	3.56	7.27	1.55	7.47	.200
F2: Job Change	PDR	60	13.53	4.35	17.81	1.39	17.79	.157
	Social Science	56	12.23	5.33	17.48	1.07	17.52	.164
	Classroom	50	13.80	3.57	17.96	1.30	17.92	.173
	Science	29	12.37	3.87	18.03	0.90	18.07	.226
F3: Sociotechnical Blindness	PDR	60	13.43	4.10	17.48	1.18	17.50	.143
	Social Science	56	11.82	4.80	17.33	1.13	17.33	.149
	Classroom	50	13.86	3.54	17.50	0.97	17.51	.157
	Science	29	12.86	4.52	17.51	1.08	17.50	.206
F4: AI Configuration	PDR	60	9.35	3.97	12.98	0.91	12.97	.120
	Social Science	56	8.50	3.79	12.82	0.87	12.84	.126
	Classroom	50	9.26	3.41	13.04	1.02	13.04	.132
	Science	29	8.65	3.56	13.06	0.92	13.08	.173

As can be seen in Table 6, the average post-test scores adjusted according to the pre-test scores of artificial intelligence anxiety for the learning factor were highest for the pre-service teachers studying in the Department of Psychological Counseling and Guidance (PDR) ($\bar{X}$ =7.64) and lowest for the pre-service teachers studying in the Department of Social Sciences Teacher Education ($\bar{X}$ =7.16). The average of the post-test scores adjusted according to the pre-test scores of the job change factor belongs to the pre-service teachers studying in the Department of Science Teaching ($\bar{X}$ =18.07) and the lowest belongs to the pre-service teachers studying in the Department of Social Sciences Teaching ($\bar{X}$ =17.52). The average of the post-test scores corrected according to the pre-test scores of the sociotechnical blindness factor belongs to the pre-service teachers studying in the departments of PDR and Science Teacher Education ($\bar{X}$ =17.50), while the lowest belongs to the pre-service teachers studying in the department of Social Sciences Teacher Education ($\bar{X}$ =17.33). The post-test scores corrected according to the pre-test scores for the factor of constructing knowledge were highest for the pre-service teachers studying in the Department of Science Education ($\bar{X}$ =13.08) and lowest for the pre-service teachers studying in the Department of Social Studies Education ($\bar{X}$ =12.84). When the pre-tests are taken under control, the ANCOVA results regarding the difference in post-test scores according to the departmental covariate are summarized in Table 7.

Table 7. Effect of Training on the Integration of Artificial Intelligence into Education on Anxiety Depending on the Department

Impact	Wilks' lambdas	F	Hip. sd	Error sd.	P	$\acute{\eta}^2$	Observed Power
Section	.929	1.138	12	487.110	0.327	0.019	0.590

As seen in Table 7, when the pre-tests were taken under control, it was determined that there was no significant difference in the post-tests in terms of department ($F_{(12.487,110)}$ =1.138, p>0.000). Accordingly, it can be said that the change caused by the training on the integration of artificial intelligence into education in pre-service teachers' anxiety toward artificial intelligence does not differ according to the department.

Table 7. Information on Codes and Categories

Code and Category	f
A. Artificial intelligence concerns	
A1. Inequality	7
A2. Ethics, Confidentiality, and Reliability	24
A3. Occupational and social anxiety	37
A4. Unpredictable Decisions and Loss of Control	25
A5. Difficulties in Technology Use and Adaptation	5
A6. Artificial Intelligence Dependency and Decline in Creativity	28
B. Artificial Intelligence: Human Collaboration and Interaction	41
C. Aspects of Artificial Intelligence that Make Life Easier	36
D. Usage Area of Artificial Intelligence	44

The semi-structured interview conducted with the students who participated in the experimental process aimed to obtain the students' thoughts on artificial intelligence concerns. Accordingly, 4 main categories were identified as Artificial Intelligence Anxieties of pre-service teachers, Artificial Intelligence-Human Cooperation and Interaction, Aspects of Artificial Intelligence that Make Life Easier and Usage Area and Benefits of Artificial Intelligence, and 6 sub-codes for the category of Artificial Intelligence Anxieties. The frequencies of these themes and codes are listed in Table 7.

The opinions of the pre-service teachers who participated in the research regarding the 4 semi-structured questions were as follows for the category of "Artificial Intelligence Concerns": Inequality (f=7), Ethics, Privacy and Reliability (f=24), Professional and Social Anxiety (f=37), Unpredictable Decisions and Loss of Control (f=25), Difficulty in Technology Use and Adaptation (f=5) and Artificial Intelligence Dependency and Decreased Creativity (f=28). Other categories were "Artificial Intelligence– Human Cooperation and Interaction" (f=41), "Aspects of Artificial Intelligence that Make Life Easier" (f=36) and "Area of Use of Artificial Intelligence" (f=44).

Source of Artificial Intelligence Anxiety

When the quantitative findings were analyzed, it was determined that the pre-service teachers had high anxiety about AI before the implementation, and at the end of the experimental process, these anxieties increased even more in terms of factors other than the learning dimension. When the qualitative data collected to determine which thoughts are at the basis of the concerns toward AI are analyzed, it is seen that the main sources of anxiety are inequality; ethics, privacy, and reliability; professional and social anxiety, unpredictable decisions, and loss of control; technology use and adaptation difficulties, AI dependency and decreased creativity. The concepts of AI concerns are presented in Figure 1.
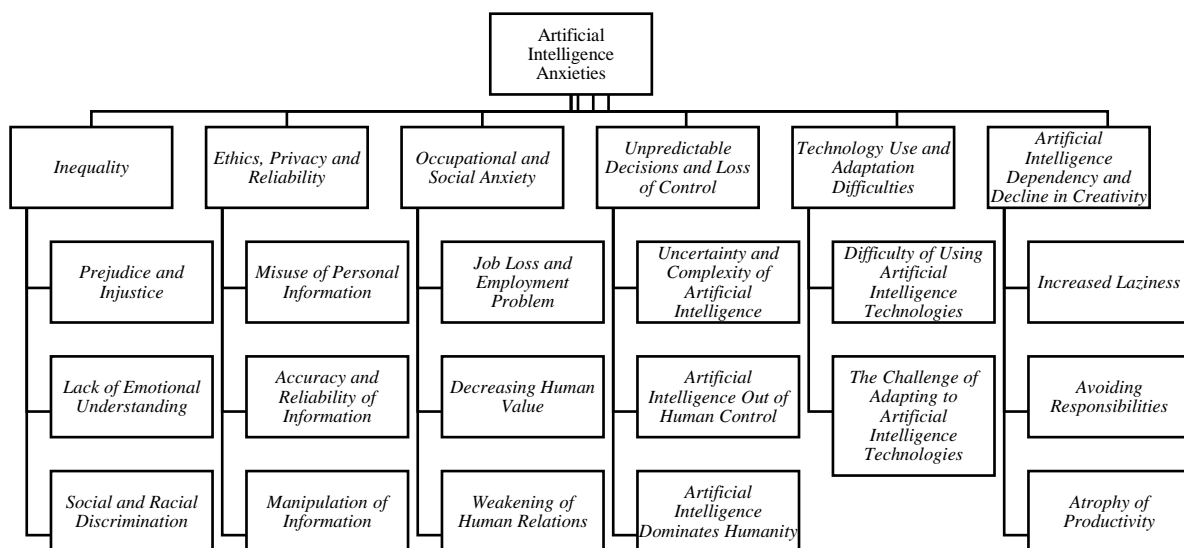

Figure 1. Artificial Intelligence Anxiety Concept Map

Figure 1 shows that inequality concern refers to biases, injustices, racial inequalities, social inequalities, and exclusion arising from the datasets on which AI technologies are trained. This can be summarized as bias and injustice, lack of emotional understanding, and social and racial segregation. The views of some participants on this issue are as follows:

P13: *"AI models can learn biases in the datasets they are trained on. This can contribute to social or racial inequalities. Lack of fairness, transparency, and diversity can lead to problems in AI applications."*

P15: *"Algorithmic bias and injustice, lack of trust in technology, lack of emotional intelligence..."*

Ethical, privacy, and reliability concerns refer to concepts such as AI technologies violating many ethical considerations, misusing personal information, unauthorized use of personal information, misinforming and misleading people, copyright infringement, and ensuring data privacy and information reliability. This can be summarized as misuse of personal information, accuracy and reliability of information, and manipulation of information. The views of some participants on this issue are as follows:

P14: *"They play on people's voices and make them say things they have never said. It has become very easy to access people's information."*

P19: *"Privacy and Security Concerns: The fact that AI systems rely on large amounts of data may increase data privacy and security concerns. In particular, there may be concerns about how personal data are used and protected. AI Ethics, there may be uncertainties and concerns about its ethical use. In particular, ethical issues such as bias, injustice, and harmful uses are important."*

Occupational and social anxiety refers to unemployment or occupational anxiety caused by the disappearance of some professions or occupations being performed by artificial intelligence, as artificial intelligence technologies fulfill many of the human duties and responsibilities, and the problems that will be experienced in social and economic terms. This situation can be summarized as job loss and employment problems, decrease in human value, and weakening of human relations. The views of some participants on this issue are as follows:

P4: *"It has a negative impact on the mental health of people who cannot find a place in the business world. Human relations decrease."*

P24: *"It may replace some professions in the future and cause people to be unemployed. This may cause economic and social problems."*

The concern of unpredictable decisions and loss of control refers to the threats and security breaches that may arise from the lack of control that may arise from the rapidly developing AI technologies becoming self-determining and self-mobilizing in the future. This situation can be summarized as the uncertainty and complexity of artificial intelligence, artificial intelligence being out of human control, and artificial intelligence dominating

humanity. The views of some participants on this issue are as follows:

P3: *"It makes me anxious because the end is uncertain."*

P13: *"Rapidly developing artificial intelligence technologies can pose risks when used uncontrolled or unmanaged. AI used unconsciously can lead to unexpected results or security problems."*

Technology use and adaptation anxiety refers to the difficulty of using artificial intelligence technologies, the difficulty of using them in the future, the fact that they will become more difficult and complex to use in the future, adaptation problems with the past generations being left behind, and that this situation will evolve into an even more difficult situation when there are people who do not want to learn and use artificial intelligence technologies. This situation can be summarized as the difficulty in using artificial intelligence technologies and adapting to artificial intelligence technologies. The views of some participants on this issue are as follows:

P2: *"It seems certain that artificial intelligence will be much more advanced in the future, but I believe that it will also become more difficult to use because I believe that it will not be so simple to use such a high technology."*

P45: *"If artificial intelligence becomes traditional in the future and is subjected to mandatory use in many institutions, many individuals from previous generations will have difficulty in using artificial intelligence."*

The concern of AI addiction and decreased creativity refers to the constant use and addiction of AI technologies, which negatively affect creativity and productivity and lead to laziness. This situation can be summarized as increased laziness, avoidance of responsibilities, and atrophy of productivity. The views of some participants on this issue are as follows:

P36: *"The widespread use of AI may cause people to lose some skills and abilities, and dependency on AI tools may also arise."*

P37: *"My biggest concern about artificial intelligence tools is that I think they will bring about the end of humanity. I think it drives humanity to laziness and tries to destroy the creative and productive aspects of people."*

Expectations for Artificial Intelligence

Although pre-service teachers have many concerns about artificial intelligence, they also have thoughts about the expectations of artificial intelligence and the use and benefits of artificial intelligence in daily life. For example, artificial intelligence and humans can benefit in many areas by cooperating. Concepts related to AI– human collaboration and interaction are shown in Figure 2.
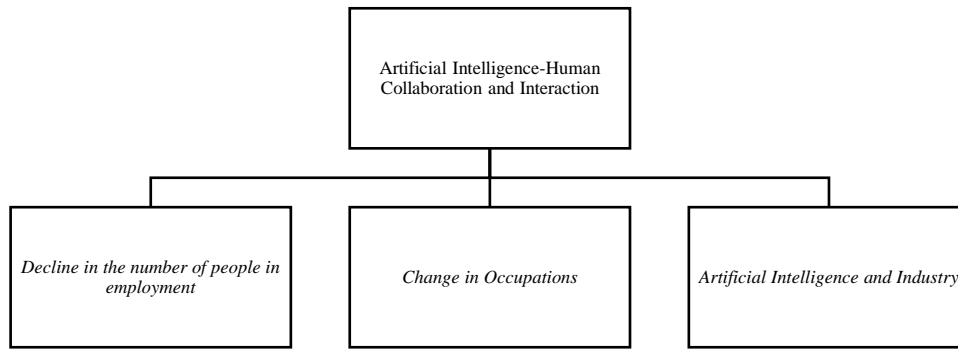
Figure 2. Artificial Intelligence: Human Collaboration and Interaction Concept Map

Figure 2 shows that artificial intelligence– human cooperation and interaction refers to the fact that artificial intelligence technologies become capable of doing people's jobs over time, the transfer of human labor to artificial intelligence, or where the labor force is excessive, artificial intelligence helps people to perform more efficiently. This situation can be summarized as a decrease in the labor force, a change in professions, and artificial intelligence and industry. The views of some participants on this issue are as follows:

P11: *"It can replace human beings in many areas, in production, in health, in machines, even in factories, it reduces the need for manpower'.*

P19: *"Artificial intelligence can replace humans in many fields or work in cooperation with humans. In some areas, the human workforce may decrease or change with the automation of human jobs or the use of artificial intelligence. In other areas, AI can support human capabilities. Manufacturing and Industry: Automation and robotics can replace human labor on production lines."*

Contributions of Artificial Intelligence

According to the statements of university students, artificial intelligence can also facilitate people's lives in different ways. Accordingly, the concepts related to the aspects of AI that make life easier are given in Figure 3.
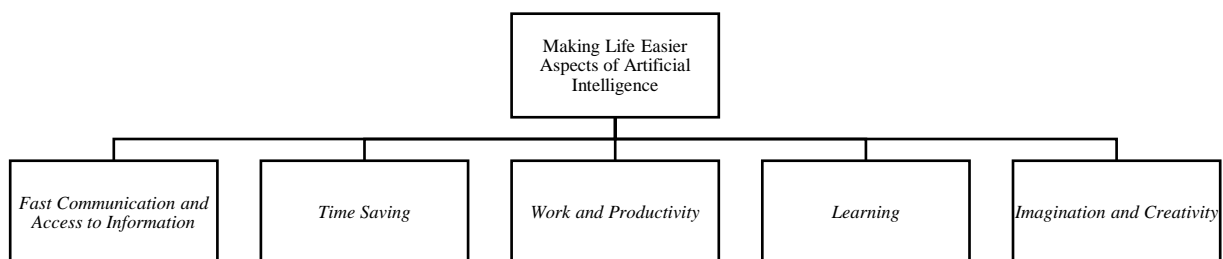

Figure 3. Aspects of Artificial Intelligence that Make Life Easier: Concept Map

Figure 3 shows that the aspects of artificial intelligence that make life easier refer to the fact that artificial

intelligence technologies are easily accessible and facilitate human life at many points, saving space and time and providing advantages in many areas. This can be summarized as fast communication and information access, time saving, work and productivity, learning, imagination, and creativity. The views of some participants on this issue are as follows:

> P15: *"There is an increase in efficiency because they can do work faster and faster than humans; by quickly analyzing large data sets, it easily finds the data we need and categorizes them quickly; artificial intelligence systems provide 24/7 service and always provide benefits when needed."*

> P23: *"It provides great convenience to individuals' lives. As the simplest example, it provides a lot of opportunities for our homework, projects, presentations, and working and business environments that we use in our lives right now. It allows us to do things that we can do by spending much time in seconds and minutes."*

According to the statements of university students, AI can be used in different fields and can provide benefits in many ways. Accordingly, the concepts related to the usage areas of AI are given in Figure 4.
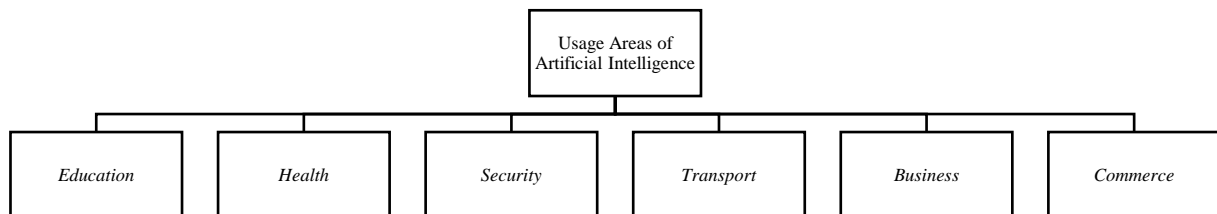

Figure 4. Concept Map of Usage Areas of Artificial Intelligence

When Figure 4 is examined, it can be said that the area of use of artificial intelligence refers to the fact that artificial intelligence technologies can be used in every field and provide advantages in many moments by reducing the workload or that the use of artificial intelligence technologies provides advantages in many professions, especially in case of error, accident, and danger. The areas of use of AI can be summarized as education, health, security, transportation, economy, and trade. The opinions of some participants on this subject are as follows:

> P6: *"AI tools can contribute to people in areas such as financial analysis, education, transportation, healthcare, and game development. If we consider education from these areas, artificial intelligence can offer customized education programs to students, allow teachers to analyze student performance, and improve education processes."*

> P10: *"It makes many contributions in health, education, automotive, banking, agriculture, mining, and media, especially in military fields. It provides many advantages in situations such as unmanned aerial vehicles, communication, and intelligence."*

Discussion and Conclusion

While training on the integration of artificial intelligence into education decreased pre-service teachers' anxiety in the learning dimension, it caused an increase in their anxiety in terms of other dimensions. The change caused by the training on the integration of artificial intelligence into education in pre-service teachers' anxiety toward artificial intelligence does not differ according to gender or department. When the qualitative data collected to determine which thoughts are at the basis of the concerns toward AI are analyzed, it is seen that the main sources of anxiety are inequality; ethics, privacy, and reliability; professional and social anxiety, unpredictable decisions, and loss of control; technology use and adaptation difficulties, AI addiction and decreased creativity.

Several studies have highlighted ethical concerns surrounding AI, including inequality, privacy, and trustworthiness (Shazly et al., 2020; Zhang et al, 2021). These concerns are particularly evident in healthcare, where the potential for AI to intensify existing inequalities and privacy issues is a major concern (Baihakki, 2023). The rise of AI has led to occupational and social anxiety and fears of unpredictable decisions and loss of control (Dietterich, 2015). Additional concerns include the potential for dependency on AI and reduced creativity (Green, 2018). It was concluded that pre-service teachers viewed inequality in terms of prejudice and injustice, lack of emotional understanding, and social and racial segregation. These perspectives are influenced by teachers' own backgrounds and experiences as well as the challenges they face in meeting the needs of diverse learners (Taylor, 2001). The role of teacher education programs in preparing teachers to address these challenges, focusing on promoting social justice and equitable educational outcomes, is crucial (Mills, 2016). Ethical, privacy, and reliability concerns were addressed by pre-service teachers in terms of misuse of personal information, accuracy and reliability of information, and manipulation of information. Preservice teachers expressed negative feelings toward AI and concerns about its potential risks and benefits (Haseski, 2019). To address these concerns, it is important to integrate AI ethics into education and ensure algorithmic transparency, privacy, and cybersecurity in AI applications (Burton, et al., 2017; Klimova et al., 2023). Professional and social concerns were addressed by pre-service teachers in terms of job loss and employment problems, decreasing human value, and weakening human relations. However, they also acknowledge the potential benefits of AI, such as improving learning experiences and task management (Al-Tkhayneh et al., 2023). There are also discussions about the potential role of AI in addressing teacher shortages (Edwards, 2018) and its use in teacher professional development (al-Zyoud 2020, Abramowitz 2022).

Fears of unpredictable decisions and loss of control have been addressed in the form of the uncertainty and complexity of AI, the loss of human control of AI, and the domination of humanity by AI. These fears are intensified by the rapid progress in AI research, with experts predicting that AI will outperform humans in various tasks over the next few decades (Grace et al., 2017). Technology use and adaptability concerns were addressed in terms of the difficulty of using and adapting AI technologies. The need for AI to be an active partner in human–computer interaction further complicates its use (Hippe et al., 2014). In education, the adoption of AI is hampered by difficulties using the technology and lack of infrastructure (Mafara 2024). The concern of AI dependency and decreased creativity has been addressed in the form of increased laziness, avoidance of responsibilities, and atrophy of productivity. The use of AI has been found to significantly affect human decision-making, laziness,

and privacy concerns (Sabharwal et al., 2023). However, the relationship between AI dependence and reduced creativity leading to increased laziness and avoidance of responsibilities is complex. Avoidance motivation can promote creativity through cognitive effort (Roskes et al., 2012), and the privacy paradox is influenced by individual laziness (Wirth et al., 2021). perceived inattention can impair self-report scales in creativity and the arts (McKibben, 2017).

Although pre-service teachers have many concerns about artificial intelligence, they also have thoughts about the expectations of artificial intelligence, the use of artificial intelligence in daily life, and its benefits. These expectations can be summarized as workforce reduction, change in professions, and AI and industry. There is a gap in understanding AI among pre-service teachers, which emphasizes the need for effective AI education (Lindner, 2020). Overall, pre-service teachers' expectations for AI in education are influenced by their understanding of AI, its potential impact on the workforce, and the need for effective AI education. According to the pre-service teachers' statements, AI can also facilitate people's lives in different ways in many areas. Several studies have emphasized the potential of AI to improve education. Chen et al. (2020) and Chassignol et al. (2018) highlight the role of AI in customizing educational content and improving teaching methods. Pannu (2015) and Ahmad et al. (2021) underline the impact of AI in various fields, including education, through expert systems and applications such as intelligent learning and intelligent tutoring systems. However, the integration of AI in education also brings challenges, such as ethical considerations and the need for teacher training (Lameras, 2021). Despite these challenges, the potential of AI to transform education and improve learning outcomes is clear. This can be summarized as rapid communication and information access, time savings, study, and productivity, learning and imagination, and creativity. It can facilitate fast communication and information access, save time, improve work and productivity, and stimulate learning, imagination, and creativity. The future of education may include a synergy between human teachers and AI, with the latter serving as an enhancement rather than a substitute (Chan et al., 2023). Although there was an increase in the anxiety levels of pre-service teachers in terms of other factors, the decline in anxiety in the learning dimension revealed that such educational processes can be beneficial. In this framework, it can be suggested to add content on the use of AI in education to teacher training programs. In addition, considering that the source of anxiety about artificial intelligence includes issues related to cybersecurity, such as inequality, ethics, privacy, and reliability, it may also be recommended to add course content to teacher training programs to develop literacy skills related to cybersecurity.

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Appendix. Details of the Courses

Week 1: Text Tools Using Artificial Intelligence

Lesson 1: Artificial Intelligence and Text Processing: Introduction and Basic Concepts

- To give students a brief introduction to the importance of artificial intelligence in education.
- What is Artificial Intelligence? Basic definitions and concepts.
- What is natural language processing (NLP)? A simple definition.
- A brief discussion on the potential of AI and NLP in education.
- To learn the basic principles of AI and text processing and how they work through a PowerPoint or similar presentation.
- Concretize concepts using real-world examples (e.g. text-based chatbots, automatic text summarization).
- Divide students into small groups to discuss how AI and text processing tools can be used in education.
- Live demo of a simple text analysis tool (Google Ngram Viewer)

Lesson 2: Practical Applications-Text Analysis and Tools

- Basic features and functions of text analysis tools.
- Provide examples of how these tools can be used in education.
- Live demonstration of the selected text analysis tool.
- A case study on how to get the most out of the tool.
- Students try out the text analysis tool.
- Students are given a simple text analysis task to complete.
- Students share their experiences. Discuss the potential applications of the tools in education.

Lesson 3: Interactive Educational Tools: Chatbots and Applications

- Fundamentals of Chatbot Technology
- Presentations of examples of how chatbots are used in education.
- Live demo of an education chatbot.
- Providing students with the opportunity to interact with the chatbot.
- Dividing students into groups and having them develop scenarios on how a chatbot can be used in education.
- Groups share their ideas with the class.
- Students discuss the advantages and limitations of chatbot technology.
- Sharing personal opinions and suggestions on the use of chatbots in education.

In the second week, the applications of visual and video processing tools in education were examined, and pre-service teachers learned how to enrich students' learning experiences with these tools by acquiring visual literacy skills brought by the digital age. Video analysis tools and multimedia learning theories made the lessons practical and interactive. The details of the lessons are as follows:

Week 2: Video and Visual Tools Using Artificial Intelligence

Lesson 1: Introduction to Visual and Video Processing

- Basic principles of visual recognition and video processing.
- An overview of its applications in education.
- Presentation supported by examples showing how visual and video processing technologies are used in education.
- Examples of the use of videos and visuals as educational materials.
- Live demonstration of simple visual recognition tools.
- Students sharing their ideas.

Lesson 2: Practical Applications and Visual Tools

- Types of visual aids and their use in education.
- Examples of the effective use of visual learning materials.
- Task students to create their own educational materials using specific visual aids.
- Group work to design classroom activities using visual aids.
- Groups share their visual materials and activities with the class.
- Evaluation of presentations and feedback.

Lesson 3: Video and multimedia

- Overview of the role of video and multimedia in education.
- Creating and using video and multimedia content.
- Video-based learning approaches in education.
- Demonstration of various video and multimedia tools used in education.
- Assign students the task of creating video-based teaching materials.
- Students design their own video and multimedia content in groups.
- Each group prepares a short video or multimedia presentation.
- Groups share their work with the class and the evaluation.

The third week focused on audio processing and music-related AI tools and provided in-depth insights into the use of these tools in the classroom, teaching pre-service teachers how to promote learning with aural materials through voice recognition and AI-assisted music creation technologies. The details of the courses are as follows:

Week 3: Audio and Music Tools Using Artificial Intelligence

Lesson 1: Introduction to Audio Processing and Artificial Intelligence

- Basic principles of voice recognition and processing.
- An overview of audio processing applications in education.
- Presentation supported by examples showing how audio processing technologies are used in education.

- Examples of the use of audio recordings and narrations as educational materials.
- Live demonstration of simple voice recognition tools.
- Provide opportunities for students to share ideas and ask questions.

Lesson 2: Practical Applications of Voice Assistants

- An overview of the importance and use of vocal aids in education.
- Types of audio aids and their use in education.
- Examples of the effective use of audio learning materials.
- Task students to create their own educational materials using specific audio aids.
- Group work to design classroom activities using audio aids.
- Groups share their audio materials and activities with the class.
- Evaluation of presentations and feedback.

Lesson 3: Music and Sound Activities

- Overview of the role of music and sound activities in education.
- Creation and use of music and audio content.
- Music-based learning approaches in education.
- Demonstration of various music and sound tools used in education.
- Assign students the task of creating music and sound-based teaching materials.
- Students design their own music and sound content in groups.
- Each group prepares a short music or sound presentation.

In the last week of the program, data analysis and reporting tools were introduced, and pre-service teachers were informed about how these tools can measure, analyze, and report student performance. Automation of data analysis, reporting and feedback processes, and creating personalized learning experiences were covered. The details of the courses are as follows:

Week 4: Data Analysis and Reporting Tools Using Artificial Intelligence

Lesson 1: Introduction to Data Analytics and Artificial Intelligence

- General information about the role of data analysis in artificial intelligence and its importance in education.
- Basic principles of data analysis and processing.
- An overview of data analysis applications in education.
- Presentation supported by examples showing how data analysis technologies are used in education.
- Examples of using data analysis tools as educational materials.
- Live demonstration of simple data analysis tools.
- Provide opportunities for students to share ideas and ask questions.

Lesson 2: Practical Applications: Student Performance Analysis

- An overview of the importance and use of student performance analysis in education.

- Types of student performance analysis tools and their use in education.

- Examples of the effective use of performance analysis in education.

- Assign students to conduct their own student performance analysis using specific data analysis tools.

- Group work to design in-class activities using data analysis tools.

- Groups share their analysis and findings with the class.

- Evaluation of presentations and feedback.

Lesson 3: Reporting and Feedback

- Overview of the role of reporting and feedback in education.

- Introduction of reporting tools and techniques used in education.

- Strategies and examples for effective reporting.

- Demonstration of reporting tools used in education.

- Assign students the task of practicing reporting and feedback techniques.

- Students develop their own reporting and feedback strategies in groups.

- Each group prepares a short report and a feedback presentation.