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Research Paper

Development and Validation of the Scale for Artificial Intelligence Anxiety

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ABSTRACT

The aim of this study was to develop a self-administering scale to assess Artificial Intelligence Anxiety (AI Anxiety). Inter-rater reliability, Cronbach's Alpha reliability, Construct validity, and Concurrent Validity of the Scale for Artificial Intelligence Anxiety have been demonstrated. Inter-rater reliability (Fleiss' Multirater Kappa) was calculated to be 0.534. The final scale was administered to a total of 881 adults from India. The sample comprised 432 males and 449 females, with ages ranging from 20-59. Cronbach's alpha was found to be 0.922. Construct Validity was established as 0.543 through Exploratory Factor Analysis. Concurrent validity established by correlating the scores to those obtained on the Artificial Intelligence Anxiety Scale (Wang & Wang, 2019) was 0.772. Mean score for the total sample was 69.41 and S.D. was 15.43. For the male sample, the mean score and S.D. were found to be 69.815 and 15.677 respectively. For the female sample, the values were 69.015 and 15.195 respectively. Higher mean values indicate greater Artificial Intelligence Anxiety.

Keywords: *Artificial Intelligence, AI Anxiety, AI in India*

Artificial Intelligence involves the development of algorithms, machine learning models, and computational systems that help machines to learn, reason, and make decisions without explicit programming (Alston, 2024). Gathering information or data from various sources, analysing the information and then putting the information to practical use is how AI algorithms are designed to work (West & Allen, 2018). Johnson and Verdicchio (2017) defined AI anxiety as "the feelings of fear and uneasiness that occur in individuals towards out-of-control AI". It is the concern or apprehension that AI technology may replace human ingenuity and make some professions obsolete (Johnson & Verdicchio, 2017). AI anxiety arises from not only direct experience but also, in many cases, indirect information and innate anxiety concerning the unknown consequences of AI decisions (Li & Huang, 2020). Li and Huang (2020), identified certain features, such as privacy, transparency, bias, and ethics to the phenomenon of AI anxiety. Kim and colleagues (2023) have defined AI anxiety as feelings of apprehension or fear stemming from the accelerated

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development of AI technologies. Johnson and Verdicchio (2017) have identified three factors that contribute to AI Anxiety. These factors include:

- An exclusive focus on AI programs that leaves humans out of the picture.
- Confusion about autonomy in computational entities and in humans.
- An inaccurate conception about technological development.

In a study by Kaya et al. (2022) on the roles of personality traits and AI anxiety on Turkish samples, attitudes toward positive aspects of AI were significantly positively predicted by subjective knowledge of AI and computer use, and negatively predicted by AI learning anxiety. AI anxiety needs to be studied as the use of AI becomes increasingly mainstream and people are forced to adapt as use of AI becomes institutional and no longer a personal choice. The present paper describes the development and validation of a scale to measure Artificial Intelligence Anxiety.

METHOD

Objective

To develop and standardise a scale to assess Artificial Intelligence Anxiety in the Indian cultural context.

Sampling Technique

The snowball technique of sampling was used for the present research. Relevant questions in the information schedule and subsequent screening of incoming responses ensured only people meeting the inclusion criteria were included in the final sample.

Sample

The normative sample of the scale included 881 adults in the age group ranging from 20 to 59, with 432 male and 449 female respondents. The total sample was divided into two age groups, 20 to 39 years and 40 to 59 years. In the first age group, that is 20 to 39 years, the total number of participants was 499 with 240 male and 259 female participants. In the second age group, that is 40 to 59 years, the total number of respondents was 382 with 192 male and 190 female participants.

Inclusion Criteria

- **Age.** 20-59 years.
- **Education.** Minimum level of education is Higher Secondary.
- **Location.** Data was collected from individuals residing in India.
- **Exposure to Technology.** Only those individuals who use or are exposed to technology and the concept of AI were included in the study. This was ascertained through questions in the information schedule.

Exclusion Criteria

- **Sex.** Only those identifying as Male or Female were included in the study. The other sexes were not included as there was not equal representation of those groups.
- **Residence.** Individuals residing in rural areas were not included in the study.

Tools

- **Consent Form.** Was prepared for the present study.

- **Information Schedule.** An Information Schedule was prepared for the present study. This sought details like sex, educational qualification, age, residence and profession.
- **Artificial Intelligence Anxiety Scale, Wang and Wang (2019)**. The scale has a Cronbach's Alpha value of 0.964 which indicates sound reliability. It has a criterion-related validity of 0.864 and satisfactory content validity, discriminant validity, convergent validity, and nomological validity. It has four factors or dimensions namely, learning, job replacement, sociotechnical blindness, and AI configuration.
  Administration. The scale is self-administering in nature. There is no time limit for completion.
  Scoring and Interpretation. The Artificial Intelligence Anxiety Scale is a 21 item, 7-point Likert scale for the measurement of AI Anxiety. Each item is rated on a scale of 1 to 7. Higher scores indicate a high level of artificial intelligence anxiety. Lower scores indicate low levels of artificial intelligence anxiety.

Procedure

A list of 74 statements was prepared for relevance rating. Considering the fact that the scale in development was an Anxiety Scale, items were not divided into positive or negative statements; rather, they were a collection of statements pertaining to future-oriented aspects of Artificial Intelligence and its globalised effects. The 74 statements were checked for relevance by 3 experts who rated them on a scale of 1 to 5. Those statements that received a score of less than 4 by even a single rater were eliminated. This left the final scale to retain 20 statements. Inter-rater reliability (Fleiss' Multirater Kappa) of the final scale was .534 which is moderate, and significant at the .001 level.

When the final 20 statements were obtained, the scale was administered to 881 persons residing within the Indian Sub-continent to assess its reliability and validity, and to establish norms. For establishing reliability of the scale, Cronbach's Alpha was used. Exploratory Factor Analysis (EFA) was conducted to determine the construct validity of the Scale for Artificial Intelligence Anxiety (SAIA) and to reveal its factor structure. For this, principal components and direct oblimin rotation were used. The direct oblimin rotation method was used since there is considered to be a relationship between the factors. The SAIA and Artificial Intelligence Anxiety Scale (AIAS) were administered simultaneously to establish concurrent validity of the scale which was found to be .772.

RESULTS AND DISCUSSION

Table 1 Inter-rater Reliability of the Scale for Artificial Intelligence Anxiety (Fleiss Multirater Kappa) for 74 Statements and 3 Raters

	Kappa	Standard Error	Sig.
Overall Agreement	.534	.129	<.001

- The Fleiss' Multirater Kappa value of .534 which is significant at the <.001 level indicates moderate inter-rater reliability.

Table 2 Cronbach's Alpha for the Scale for Artificial Intelligence Anxiety

Cronbach's Alpha	Number of Items
.922	20

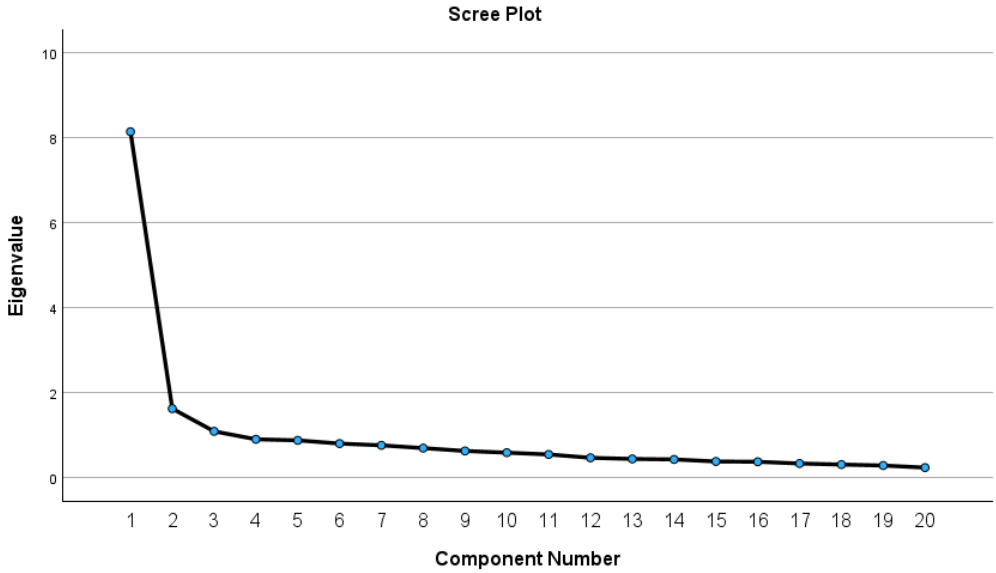
- Cronbach's Alpha value of .922 indicates good reliability of the present scale.

Table 3 Kaiser-Meyer-Olkin (KMO) sample adequacy test and Bartlett's Test of Sphericity results

KMO Measure of Sampling Adequacy	.926
Bartlett's Test of Sphericity Approx. Chi- Square	3078.040
df	190
Sig.	<.001

- The Kaiser-Meyer-Olkin (KMO) sample adequacy value was found to be .926, showing that the sample size was sufficient for Exploratory Factor Analysis (EFA).
- Bartlett's test significance value is less than .05 which further confirms sample adequacy.

Fig. 1 Scree Plot depicting how much variation each principal component has captured from the data.



- The Scree Plot shows a sharp decline till number 2 and plateaus out after that. Hence, 2 factors or domains namely — Factor 1: Threat to Collective Well-Being and Factor 2: Threat to Individual Well-Being have been retained in the present scale.

Table 4 Results of Scale for Artificial Intelligence Anxiety Factor Analysis (Pattern matrix and Total Variance explained)

Items	Factor 1	Factor 2
1	-.705	
2	-.849	
3	-.801	
4		.556
5	.800	
6	.810	
7	.759	
8		.446
9	.541	
10		.582
11		.489
12		.404

Items	Factor 1	Factor 2
13		.455
14		.780
15	.777	
16		.838
17	.490	
18		.536
19	.434	
20	.797	
Eigenvalues	8.147	3.723
% Variance Explained	40.736	13.615
% Total Variance Explained	54.351	

- The Pattern Matrix shows that all the factor loadings are greater than 0.4 indicating a sound structure.
- Exploratory Factor Analysis showed that two factors or dimensions emerged in the scale with Eigenvalues greater than one.
- The cumulative Total Variance Explained by these two factors or dimensions is 54.35%.
- Hence, we can say that the construct validity of the present scale developed is .544 which is moderately good.

Table 5 Mean and Standard Deviation of scores obtained by males and females on the Scale for Artificial Intelligence Anxiety

Sample	N	Mean	S.D.
Male	432	69.815	15.677
Female	449	69.015	15.195
Combined	881	69.407	15.430

- Higher mean values indicate greater AI Anxiety.
- Mean values for male participants and female participants, and the combined sample are greater than the median, which is 60.

Table 6 Mean and Standard Deviation of scores on the Scale for Artificial Intelligence Anxiety grouped by age and sex

Age	N	Sex	Mean	S.D.
20-39	240	Male	69.52	15.81
	259	Female	68.66	14.61
	499	Combined	69.08	15.19
40-59	192	Male	70.18	15.54
	190	Female	69.49	15.98
	382	Combined	69.84	15.75

- Higher Mean values show an increased tendency of AI anxiety
- Mean values for respondents of all age groups are greater than the median, which is 60.

Table 7 Correlation values of the SAIA and AIAS

	AIAS	sig.
SAIA	.772	<.001

Inter-rater reliability of the scale was assessed using Fleiss' Multirater Kappa whose value was found to be .534. According to Altman (1999), and Landis and Koch (1977), a Fleiss' Multirater Kappa value of .534 indicates moderate agreement between the raters and the findings are significant at the .001 level. Internal consistency of the Scale for Artificial Intelligence Anxiety was measured using Cronbach's Alpha which was found to be .922, which indicates good reliability.

Correlation matrix of the 20 items in the test showed a determinant of .052 which is sufficiently greater than the cut-off value of .001 hence showing that the items have sufficient inter-correlations. In addition to this, none of the inter-item correlations on the correlation matrix exceed 0.5, with the highest correlation coefficient being 0.481, indicating no multi-collinearity. The Kaiser-Meyer-Olkin (KMO) sample adequacy value was found to be .926, showing that the sample size was sufficient for Exploratory Factor Analysis (EFA). This value is considered sufficient when it is above .50 and here, the present value is classified under the "Superb" category (Field, 2009 p. 647). The communality values calculated were also found to be the lowest at 0.395 (i.e., greater than 0.3), confirming that the sample was sufficient. In addition, as a result of Bartlett's Test $x^2(190) = 3078.040$; $p < .001$ and this finding showed that the correlations between the items were large enough for EFA.

As a result of EFA, it was determined that the SAIA, which consists of 20 items, consists of a structure with two sub-dimensions (factors), and these two factors explained 54.351% of the total variance. Based on the nature of statements in these dimensions they have been so named — Factor 1: Threat to Individual Well-being; Factor 2: Threat to Collective Well-being. According to this, it may be concluded that the SAIA has a valid structure.

As a result of the above variance value, the SAIA has a construct validity of .544 which is moderately good.

Correlation between the respondents' scores on the SAIA and the AIAS was found to be .772 which shows good concurrent validity of the present scale.

CONCLUSION

The aim of the present study was to develop a scale to assess Artificial Intelligence Anxiety among Indian adults. The Scale for Artificial Intelligence Anxiety has been standardised on the adult population residing in India, and was found to have an inter-rater reliability (Fleiss' Multirater Kappa) of .534, reliability (Cronbach's Alpha) of .922 and construct validity of .544. Concurrent validity of the SAIA was established by comparing it to AIAS (Wang & Wang, 2019) which yielded a value of .772 showing sound concurrent validity. The present scale may be used by Government bodies, employers, AI developers, and other stakeholders to assess Artificial Intelligence Anxiety in the Indian context.

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Conflict of Interest

The author(s) declared no conflict of interest.

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APPENDIX A

S.A.I.A

The present scale uses the term AI, which is an abbreviation for Artificial Intelligence, used to denote machines and robots run by Artificial Intelligence. Artificial intelligence (AI) refers to the simulation of human intelligence processes by machines, typically computer systems.

Please read the following statements carefully and select the option that applies to you the most on a scale of 5 to 1 where,

5=Always
4=Often
3=Sometimes
2=Rarely
1=Never

Sl. No.		Always	Often	Sometimes	Rarely	Never
1	I fear that the increased use of AI will lead to declined problem solving and critical thinking abilities in people.					
2	I am worried that I might struggle to keep pace with the continuous advancements in AI technology.					
3	I am anxious about AI potentially replacing the human workforce.					
4	I am uneasy about the possibility of AI becoming powerful enough to control the world and humans.					
5	I am apprehensive that my current skill set may not be sufficient for the rising AI-dominated work landscape.					
6	I am apprehensive that AI advancements may lead to a situation where those who are not adept at handling it will be left behind in the technological world.					
7	I am afraid that AI being able to fully mimic human emotions and actions, will lead to increased events of deception, robbery, etc.					
8	I am worried that AI could be exploited as a tool for increased criminal activities and cybercrimes.					
9	I am worried that AI may be misused to create 'deepfakes,' which can spread false information and defame individuals.					
10	I fear that governments and political actors can misuse AI to generate texts, images, videos, etc in order to manipulate public opinion in their favour.					
11	I am apprehensive that AI could be exploited to instigate AI-enabled terrorism.					
12	I am apprehensive that the increased use of AI in educational sectors will dehumanize the learning experience for students.					
13	I am worried that the increased use of AI in educational sectors can lead to a loss of human led classroom dynamics.					
14	I am afraid that AI could be employed in developing military equipment and weapons.					

15	I am apprehensive about AI using my data and creating a feed page that will entail to my likings to increase my social media usage.					
16	I am worried about the several ethical and privacy concerns related to the use of AI chatbots providing mental health services.					
17	I am uneasy about being under constant surveillance while using technological devices.					
18	I am apprehensive that the use of AI might lead to human isolation and hinder community building.					
19	I am worried that AI usage might affect my interpersonal relationships.					
20	I am uneasy about the prospect of job insecurity in the future because of the increasing use of AI technologies.					

Scoring of the SAIA

Summation of the Raw scores provides the Total AI Anxiety Score.

- There are no reverse scored items. All items are scored directly on a scale of 1 to 5, 1 being lowest and 5 being highest.
- Higher the Total Score, greater the AI Anxiety. The median Score is 60. Scores above median are generally considered to be on the higher side.
- Division of statements under each dimension:
  Threat to Individual Well-being: 1, 2, 3, 5, 6, 7, 9, 15, 17, 19, 20
  Threat to Collective Well-being: 4, 8, 10, 11, 12, 13, 14, 16, 18