

Development and Validation of the Scale for Attitude Toward Artificial Intelligence

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ABSTRACT

The aim of this study was to develop a self-administering scale to assess attitude toward Artificial Intelligence (AI). Inter-rater reliability, Cronbach's Alpha reliability and Construct validity of the Scale for Attitude Toward Artificial Intelligence have been demonstrated. After a preliminary survey on 342 undergraduate students from Kolkata, a set of 30 questions pertaining to attitude toward AI were finalised with the help of experts. Inter-rater reliability (Fliess Multirater Kappa) was calculated to be 0.438. The final scale was administered to a total of 526 undergraduate students from Kolkata. The sample comprised 183 male and 343 female students, with ages ranging from 18-23. Cronbach's alpha was found to be 0.832. Construct Validity was established as 0.679 through Exploratory Factor Analysis. Mean score for the total sample was 96.55 and S.D. was 13.66. For the male sample the mean score and S.D. were found to be 97.05 and 14.6 respectively. For the female sample, the values were 96.27 and 13.16 respectively. Higher mean values indicate more positive attitudes toward Artificial Intelligence.

Keywords: *Artificial Intelligence, Attitude toward AI, Student and AI*

According to McCarthy (2004), artificial intelligence (AI) is the science of making intelligent machines, especially intelligent computer programs; however, AI does not have to confine itself to methods that are biologically observable. Artificial Intelligence attempts to simulate human intelligence which encompasses decision making, pattern recognition, problem solving, etc. Automation is simply a pre-programmed software that can work with data and make a fixed set of responses to that data. Automation can run with AI, but it is usually used for performing repetitive tasks with a pre-existing set of rules. The biggest difference between a robot and AI is that robots have physical form (often mimicking humans) while AI is a software programme. Robots may use AI to learn and improve their functioning, however, it is not necessary. Robots can also work on simple automation software with a set of pre-programmed responses.

An online survey conducted by NIAS Bangalore (2019) found that 76% of the respondents felt that AI will positively change the way people live and work. However, the respondents also expressed their concern about the potential loss of jobs, loss of privacy, and a widening

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gap between the rich and the poor brought about due to the spread of AI in public life. Worldwide, studies have been conducted to assess the attitudes of people toward AI being applied in various fields. Results have shown that attitudes toward AI vary significantly based on the field of work where it is being applied (Horsfall et al., 2021; Vasiljeva et al., 2021; Aitken et al., 2020). With respect to culture, significant differences have not been proven through studies (Persson et al., 2021; Sindermann et al., 2021).

According to Hinz et al. (2019) the influence of robots on human behaviour is modulated by their attitude toward robots in general. Hence, if robots are to become a major part of the daily lives of people at large, it is imperative to study the attitudes of the very population for whom the robots are being developed.

In a study by Schepman and Rodway (2020), participants viewed AI applications involving big data (e.g. astronomy, law, pharmacology) positively, but viewed applications for tasks involving human judgement, (e.g. medical treatment, psychological counselling) negatively. The present paper describes the development and validation of a scale to measure attitude toward AI.

METHOD

Sampling technique

Multistage Systematic Random Sampling was used partially for both the preliminary survey and the main study. A list was prepared of Undergraduate colleges in Kolkata. The list included colleges of all disciplines and streams including medical, engineering, and performing arts. These colleges were categorised geographically into North, East, West, South, and Central. These were further categorised as Male, Female, and Co-educational colleges. An attempt was made for there to be an equal representation of male, female, and co-educational colleges. Beyond this point, the sample comprised those students who were present in class on the day of data collection and were willing to give data.

Sample

The present study was done on undergraduate students from Kolkata. The student population was chosen because the current college-level population is going to be the workforce that uses Artificial Intelligence first in a major way, yet, did not grow up with it.

Preliminary Survey for Preparation of Statements

The preliminary survey was conducted on 150 male and 192 female undergraduate students from colleges of multiple streams like Arts, Science, Commerce, Medicine, and engineering.

Main Study for Standardisation of the Scale

Data for the main study was collected from 183 male and 342 female undergraduate students from colleges in Kolkata from multiple streams like Arts, Science, Commerce, Medicine, and engineering.

Inclusion Criteria. The inclusion criteria of the sample are as follows.

- **Age.** 18-23 years
- **Education.** Minimum level of education is Higher Secondary. The respondents were enrolled in an undergraduate college in an Honours course or equivalent.
- **Location.** Data was collected from students studying in undergraduate colleges in Kolkata, West Bengal.

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- **Exposure to Technology.** Only those students who own personal smartphones were included in the study.

Tools

- **Information Schedule.** An information schedule seeking demographical was prepared and used.
- **Survey Schedule.** A brief survey schedule was prepared for the preliminary study which comprised questions to gauge the extent of knowledge regarding Artificial Intelligence amongst the undergraduate population of Kolkata.
- **Scale for Attitude Toward Artificial Intelligence.** The scale comprises 30 statements and follows a 5-point Likert format (ranging from 1-5), measuring attitude toward AI along the dimensions of (a) General, (b) Applications, (c) Perceived benefits, (d) Concerns. The scale is self-administering in nature with the instructions printed on the data sheet. There is no time limit for completion. The respondents' scores have a possible range of 30-150.

Procedure

The present work was carried out in two phases:

- **Phase 1.** Preliminary survey conducted on undergraduate students of Kolkata to obtain an understanding of their present knowledge about AI.
- **Phase 2.** Construction and standardisation of a scale to measure Attitude toward AI

In Phase 1 of the study, a preliminary survey was done where an open-ended survey was conducted on a sample of 342 (150 male 192 female) undergraduate students from different fields to gauge their present knowledge regarding artificial intelligence. Based on the information gathered, dimensions and statements of the scale were developed.

In Phase 2, firstly, on the basis of analysis of the data collected during the preliminary survey, a list of 50 statements were prepared which were divided into the dimensions of — general, applications, perceived benefits, and concerns related to Artificial Intelligence. The statements were divided into positive and negative statements (to be scored in reverse). Positive statements can be related to utility, competence, and efficiency of AI while negative statements can look at the concerns regarding protection of data, privacy, job-loss, adaptability, ease of use etc.

The 50 statements were checked for relevance by 6 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 30 statements. Inter-rater reliability (Fliess Multirater Kappa) of the final scale was .438 which is moderate.

When the final 30 statements were obtained, the scale was administered to 526 undergraduate students to assess its reliability and validity, and 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 Attitude Toward Artificial Intelligence (SATAI) 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.

RESULTS AND DISCUSSION*Table 1 Mean and Standard Deviation of scores obtained by males and females on the Scale for Attitude Toward Artificial Intelligence*

Sample	Mean	S.D.
Male	97.05	14.6
Female	96.27	13.16
Combined	96.55	13.66

- Higher Mean values indicate more positive attitudes toward Artificial Intelligence.
- Mean values for Male students, female students, and the combined sample are greater than the median, which is 90.

Table 2 Results of Scale for Attitude Toward Artificial Intelligence Factor Analysis

Items	Factor 1	Factor 2	Factor 3	Factor 4
1	.669			-.510
2	.579			.453
3			.579	
4				.497
5	.564			
6		.620		
7		.679		
8		.677		
9		.666		
10				.605
11		.467		
12		.652		
13				.697
14		.731		
15		.675		
16			.392	
17		.482		
18		.446		
19	.489			
20	.543			
21		.397		
22		.559		
23		.564		
24		.464		
25		.407	.584	
26	.534		.684	
27	.325		.767	
28		.453	-.372	
29				.521
30	.329			.735
Eigenvalues	6.476	3.912	2.056	1.675
Variance Explained	21.588	13.040	6.854	5.582
Total Variance Explained	47.064			

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The mean score for males was found to be 97.05, and the mean score for females was found to be 96.27. Both these mean scores lie above the median score, which is 90. Overall mean of the Scale for Attitude Toward Artificial Intelligence was found to be 96.55, which is also above the median score. Overall standard deviation was found to be 13.66. Hence, the present study found that the attitude toward Artificial Intelligence amongst undergraduate students in Kolkata is marginally above the median. Any score above median is to be considered a positive attitude while scores lying below the median are considered a negative attitude. Higher the score, more positive is the respondent's attitude toward Artificial Intelligence.

Internal consistency of the Scale for Attitude Toward Artificial Intelligence was measured using Cronbach's Alpha which was found to be 0.832, which indicates reasonably good reliability.

The Kaiser-Meyer-Olkin (KMO) sample adequacy value was found to be 0.747, showing that the sample size was sufficient for EFA. This value is considered sufficient when it is above 0.50 (Field, 2009 p647) and classified in the 'Good' category between 0.70 and 0.80. The KMO values calculated were also found to be the lowest at 0.522, confirming that the sample was sufficient. In addition, as a result of Bartlett's Test $\chi^2(435) = 7248.429$; $p < 0.05$ 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 SATAI, which consists of 30 items, consists of a structure with 4 sub-dimensions (factors), and these factors explained 47.064% of the total variance. The four sub-dimensions are: General, Applications, Benefits, Concerns, According to this, it may be concluded that the SATAI has a valid structure.

CONCLUSION

The aim of the present study was to develop a scale to assess attitude toward Artificial Intelligence among undergraduate students of Kolkata. Though the scale has been standardised on the student population, the items are such that the instrument may be standardised on other adult populations as well. The Scale for Attitude Toward Artificial Intelligence was found to have an inter-rater reliability of .438, reliability (Cronbach's Alpha) of 0.832 and construct validity of 0.679. Concurrent validity of the SATAI may be established by comparing it to similar instruments. The present scale may be used by Government agencies, employers, AI developers, and other stakeholders to assess an individual's attitude toward Artificial Intelligence.

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Conflict of Interest

The author(s) declared no conflict of interest.

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APPENDIX A

Scale for Attitude Toward Artificial Intelligence

The present scale uses the term AI to denote Artificial Intelligence, and machines and robots run by Artificial Intelligence. Artificial Intelligence refers to a software that can perform functions like reasoning and decision-making without human control and can eventually even update itself without human intervention.

Please read the following statements carefully and tick the appropriate column based on your own views of each statement. 1=Strongly Disagree, 2= Disagree, 3=Undecided, 4= Agree, and 5=Strongly Agree

SN	Statements	1	2	3	4	5
1	AI is an advanced technology that is only beneficial for the wealthy					
2	Spread of AI-based machines and software in every sector will reduce socialization so it is not suitable for Indian culture					
3	With AI-based digital assistants taking care of routine tasks, people will have more free time to indulge in art and culture					
4	AI-based machines will increase unemployment by replacing humans in jobs					
5	I will never trust a machine/software more than a human					
6	AI-based software will make banking more efficient in India by reducing errors					

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SN	Statements	1	2	3	4	5
7	I would be willing to visit a doctor/pathologist who uses an artificially intelligent machine for diagnosis					
8	A machine operated by AI will increase the success rate of surgical operations					
9	AI based smartphone apps can help me manage my personal finances a lot better than any other person					
10	Humans might lose control over AI-based robots at some point if it becomes too advanced					
11	Use of AI in warfare will give developed countries an unfair advantage					
12	AI based disaster-management system to predict disasters should be implemented urgently					
13	Use of AI-based machines will isolate people from each other					
14	I would enjoy if a travel app or hotel provides me personalized service with the help of AI					
15	Use of AI in providing customer-specific tailored suggestions during shopping saves a lot of time and effort					
16	Since AI is a software, it will not discriminate on the basis of caste and gender					
17	AI-based software can speed up the crime-solving rate in our country					
18	AI will take the human touch away from doctor-patient interactions					
19	Artificial intelligence can never be equal to human intelligence					
20	Implementation of AI is just a way for large companies to make money					
21	AI-based machines can identify traffic-rule violations more accurately than the police					
22	If court cases were presented to Robots using AI instead of human judges, impartiality would be assured					
23	AI-based software can diagnose psychological disorders more accurately than mental health professionals					
24	Use of AI-based machines in agriculture will increase the divide between rich and poor farmers					
25	Replacing Executives with Chatbots using AI have largely improved customer service in India					
26	AI-based machines and software will reduce margin of error in tasks by eliminating the human error factor					
27	Problem-solving capabilities of AI-software can help find solutions for sustainable living which human beings have not been able to find					
28	AI-based machines will make banking services more accessible to people					
29	Machines using AI will transmit my private data to the Government and Multinational Corporations					
30	AI will make people even more technology dependent in a harmful way					

APPENDIX B

Scoring of the SATAI

Summation of the Raw scores provides the Total Attitude Score.

The following items are to be scored in REVERSE: 1, 2, 4, 5, 10, 11, 13, 18, 19, 20, 24, 29, 30.

Higher the Total Score, more positive the Attitude toward AI. The median Score is 90. Any score above median is to be considered a positive attitude while scores lying below the median are considered a negative attitude. Higher the score, more positive is the respondent's attitude toward Artificial Intelligence.

Division of statements under each dimension:

- General: 1*,2*,5*,13*,19*,20*
- Perceived Benefits: 3,16,26,27
- Concerns: 4*,10*,29*,30*
- Applications: 6,7,8,9,11*,14,15,17,18*,21,22,23,24*,25,28