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Construction And Validation of a Scale For Measuring Aggression In Adolescents

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Abstract
The scarcity of psychometric scales has been a barrier to progress in the field of research on aggressive behavior in adolescents. The present study elucidates the process of constructing and validating an aggression scale that measures the attitude of adolescents towards aggression. The researcher employed a standardized approach to construct the aggression scale for the purpose of assessing levels of aggression among secondary school students. The present study involved the application of both exploratory and confirmatory factor analyses to the responses of the sample of adolescents, ranging in age from 11 to 14 years, with a total sample size of N=1200 participants. In order to assess the reliability of the scale, Alpha Cronbach and Composite reliability has been established. The items were divided into four factors having satisfactory factor loading values. All of the items that make up the factors were thoroughly analyzed and labeled as "Attitude towards aggression, Psychosocial and cognitive assessment, Behavioral assessment, and Social relationship". The four factors comprising the final Aggression Scale (AS) all demonstrated satisfactory Alpha Cronbach and Composite reliability. To verify the four-component structure of the aggression scale that was obtained through exploratory factor analysis, confirmatory factor analysis was subjected to the data obtained from the second sample of secondary school students (N=1200) with the help of IBM-AMOS Version 23.0. The model fit indices of the scale were adequate (RMSEA=0.042), indicating a good model fit (CFI=0.97, TLI= 0.97). The validity of the tool was measured through three types: i) Content validity ii) Convergent validity and iii) Divergent validity. All the parameters of assessing validity were satisfactory for the development of the aggression scale. The aggression scale offers a valid and reliable instrument for assessing adolescents' aggressive behavior.

Keywords: Adolescence, Aggression, Confirmatory factor analysis, Exploratory factor analysis, Standardization.

Abbreviations: AS: Aggression Scale; EFA: Exploratory Factor Analysis; CFA: Confirmatory factor analysis, AVE: Average variance extracted; CR: Composite Reliability; CFI: comparative fit index; TLI: Tucker-Lewis's index; RMSEA: root mean square error of approximation.

Introduction

Aggression is derived from the Latin word 'aggressus,' which means to assault, and from the word 'ion,' which means action, process, or condition. Every day, we use the word "aggression" to characterize the behavior of others and even ourselves. We label people aggressive when they yell at or beat each other, cut off other automobiles in traffic, or smash their fists on the table in rage. According to Baron and Richardson (1994), it is an action that seeks to harm another person who does not desire to be harmed. One of the most pressing issues in today's youth is classroom aggression. It is often characterized as a behavior that causes others to be wounded or harmed. Aggression in the form of road rage, domestic violence, rape, sexual assault, nasty comments to others, and ragging is prevalent everywhere nowadays. Aggression can be operationalized as a lack of respect for elders, frequent quarrels, broken engagements, revenge urges, and regressive attitudes against traditions and values (Chauhan and Tiwari, 1972). Most young children suffer from various behavioral issues such as hyperactivity, aggression, violation, non-compliance, social disengagement, and disruptive behavior resulting from an undesirable and unfavorable environment at home, school, and society. Aggressive behavior is the most troublesome among all these behavioral challenges, and it is of critical concern not just for parents and teachers, but also for the entire community. Aggression is sometimes used as a phrase for a wide range of complicated and multifaceted events that transcend clear description or explanation. Researchers around the globe must now look at all components that contribute to aggressiveness, as even the slightest trigger can lead to violence, whether physical assault or verbal aggression, as it is a matter of vital concern and a multifaceted societal issue. In order to truly understand aggression among secondary school students, it is essential to understand the association between adolescents' attitudes, psychosocial and cognitive assessment, behavioral assessment, and environment or social relationship towards aggression.

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The concept of aggression is not new to the world as a vast number of studies in this field have proved its effectiveness. Various researchers (Buss and Perry 1992, Pal and Naqvi 2000, Mathur and Bhatnagar 2004, Michel and others 2014, Webster and others 2015) have validated and standardized their scales concerning different dimensions of aggression. The present researchers analyzed all the available scales on aggression and found that none of them is comprehensive enough to include all dimensions (Psychosocial, Cognitive, behavioral, and environmental/Social relationship) of the concept. The present investigators tried their best to include all the concepts of aggression and to make the scale all-inclusive.

Objective

The present research aims to develop and standardize an Aggression Scale (AS) that would help reconcile differing approaches to adolescent aggressive behavior.

Method

The construction of the Aggression Scale (AS) involved a thorough review of pertinent literature, including books, journals, articles, and other relevant sources. Considering the escalating prevalence of aggressive behaviors in various instances among adolescents, the present researchers made considerable effort to figure out ways for assessing adolescents' attitudes towards aggression. Due to its widespread use and relatively simple to understand, the Likert Scale was the preferred method for constructing the Aggression Scale (AS). The following stages were performed by the researchers to construct and validate the scale, as indicated in the flow chart. Fig (1)

Stage I (Construction stage)

This is the first step that investigators have to take to construct the items. There are some resources through which we can determine the dimensions. These resources are exhausted literature review and studies (Ramirez, 2003; Reyna & others, 2011; Michel & others, 2014; Cenkseven-Onder & others, 2016; etc.) as well as existing tools (Buss & Perry, 1992; Bernstein & Gesn, 1997; Huesmann and others, 2011; Mathur and Bhatnagar, 2012; Garcia-Sancho and others, 2016). These resources helped the researchers to determine the dimensions. For constructing the present tool, the researchers determined four dimensions. After determining the dimensions of the tool, general objectives for each dimension were formulated. To measure these objectives, 76 items were constructed with the help of existing literature and tools related to aggression (Buss & Perry, 1992; Mathur and Bhatnagar, 2012; Garcia-Sancho and others, 2016; etc).

Stage II (Consultation Stage)

This stage includes a preliminary rating of items through experts. This step also helps the researchers to estimate the content validity of the tool.

Experts' Rating/Content Validity

The initial draft consisted of 76 items in the English language. The items were translated into Hindi language also. While translating the items, all the parameters of translation validity suggested by (Streiner et al, 2015) were followed. Ten experts from the field of education and psychology belonging to different universities were selected to evaluate the items on two parameters, i.e., relevance and clarity (Zamanzadeh et al, 2015). On the basis of the responses, the items were deleted or altered. Polit & Beck (2006) and Polit et al (2007) argued that while the research tool is being evaluated by atleast six experts, the value of CVI should not be less than 0.83 (Yusoff, M.S.B., 2019).

Thus, out of 76 statements, only 70 were retained based on the recommendations of the experts, while 06 items (CVI<0.83) were deleted. Therefore, this step led the researchers with first draft consisting 70 items.

Stage III (Examination Stage)

(First Field-Try Out)

It was decided to administer the first draft on 500 secondary school students, consisting of 70 items with three different response options (Yes/No/I Don't Know). The selection of statements was based on the "t" value, which must be equal to or greater than 1.75, as suggested by (Edwards, 1957). Thus, 50 items were selected, and 20 items were eliminated. The t-value of all the items is presented in the below table (1).

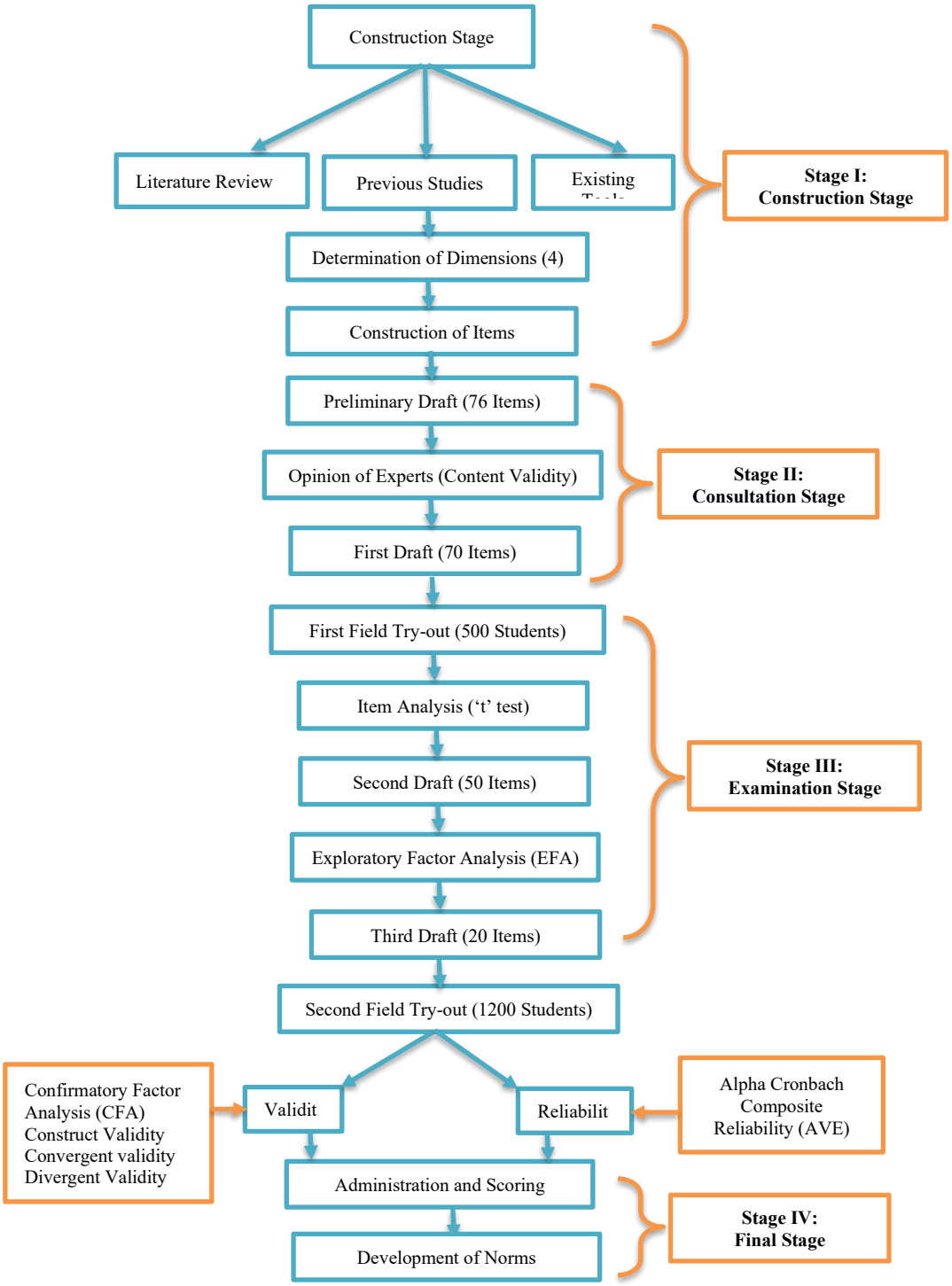

Figure 1: *Various stages of scale construction and validation*

Source: Prepared by the investigators themselves

Table 1: *'t'-values of the items*

Item No.	't' value	Item No.	't' value	Item No.	't' value	Item No.	't' value	Item No.	't' value
1	5.0	16	1.0*	31	12.25	46	8.14	61	2.44
2	3.83	17	8.0	32	0.4*	47	7.28	62	1.3*

3	1.6*	18	0.55*	33	0.8*	48	0.25*	63	1.2*
4	8.88	19	13.7	34	1.3*	49	7.6	64	7.42
5	8.71	20	5.75	35	7.37	50	6.66	65	5.62
6	2.5	21	11.5	36	8.16	51	3.8	66	1.3*
7	0.64*	22	6.4	37	9.33	52	8.57	67	6.0
8	6.16	23	7.6	38	1.5*	53	1.2*	68	2.3
9	6.6	24	6.88	39	4.2	54	1.6*	69	0.6*
10	7.28	25	10.85	40	4.87	55	6.57	70	3.0
11	1.2*	26	1.2*	41	1.6*	56	8.0		
12	4.87	27	1.0*	42	4.14	57	2.55		
13	6.71	28	4.7	43	5.16	58	7.28		
14	0.7*	29	8.0	44	7.71	59	6.11		
15	6.66	30	8.85	45	13.16	60	5.5		

Note: Items with an asterisk (*) represent insignificant 't'-values.

This step led the researchers to delete 20 items. In this way, the second draft was prepared consisting of 50 items.

Exploratory Factor Analysis

The dimensionality of the items was determined using exploratory factor analysis. Before doing the exploratory factor analysis (EFA), the Kaiser-Meyer-Olkin test (KMO=.88) and Bartlett's statistic indices ($X^2(190) = 6992.083$, $p<0.000$) were computed, and the results of these tests indicate the suitability of the data for the study (Abd ELHafeez, 2022). The latent dimensions of the data were identified using exploratory factor analysis (EFA) with the extraction of principal components and varimax rotation. The results of exploratory factor analysis are shown in tables (2 and 3) below.

Table 2: *Exploratory Factor Analysis*

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		**.88**
	Approx. Chi-Square	**6992. 083**
Bartlett's Test of Sphericity	**df**	**190**
	Sig.	**.000**

Table 3: *Factor Loadings*

Factors and Items	**Factor Loading**			
	1	**2**	**3**	**4**
Factor 1: Attitude towards Aggression				
Item No. 1.	.79			
Item No. 2.	.94			
Item No. 3.	.82			
Item No. 4.	.89			

Item No. 5.	.86			
Factors and Items	**Factor Loadings**			
	1	**2**	**3**	**4**
Item No. 6.	.70			
Item No. 7	.85			
Item No. 8	.86			
Factor 2: Psychosocial and Cognitive Assessment				
Item No. 9		.92		
Item No. 10.		.91		
Item No. 11.		.74		
Item No. 12		.90		
Item No.13		.80		
Factor 3: Behavioural Assessment				
Item No. 14.			.62	
Item No. 15.			.52	
Item No. 16.			.92	
Factor 4: Social relationship				
Item No. 17.				.62
Item No. 18.				.51
Item No. 19.				.64
Item No. 20.				.59

Note: Factor loadings with a value of less than 0.4 are omitted from the table.

The rotation converged in 5 iterations.

The scree plot was used to identify the optimal number of factors to retain through analysis. The elbow, or point where the slope of the curve visibly levels off, indicates the number of components generated by the analysis.

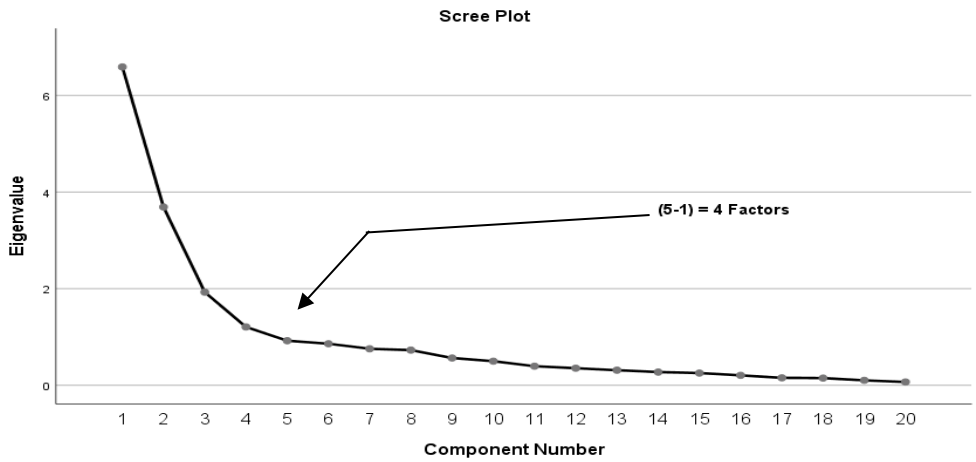

Figure 2: *Number of factors based on eigenvalue*

The results of exploratory factor analysis (EFA) deleted 30 items having less than 0.4-factor loading. The remaining 20 items were divided into four factors having satisfactory factor loading values. If the factor loading is more than 0.4, it implies that all of the statements can be included in the scale since they are relevant and suitable (Costello and Osborne, 2005). All of the items that make up the factors were thoroughly analyzed and labelled as *"Attitude towards aggression, Psychosocial and cognitive assessment, Behavioural assessment, and Social relationship".* The factor loading of the scale items ranged from .51 to .94 and the eigenvalues of the four factors were 6.59, 3.69, 1.92, and 1.20 respectively. It was determined that 67% of the total variance was explained by the statements. In the field of social science research, a variation explained by scale items of more than 50% is regarded as adequate (Uslu, 2021).

This step led the researchers to third draft consisting of 20 items.

Stage IV (Final Stage)

This stage is undertaken to ascertain various measures of reliability and validity of the tool and determine parameters for the norms.

Second Field-Tryout

A second field tryout of 1200 students was conducted on the third draft, which consisted of 20 items. The sample size was kept large since the researchers intended to evaluate the tool's reliability and validity as well as the norms. The subsequent paragraphs address the findings of confirmatory factor analysis (CFA) as well as various measures of validity (Convergent and Divergent) and reliability.

Confirmatory Factor Analysis

To validate the four-component structure of the aggression scale acquired through exploratory factor analysis, confirmatory factor analysis was used to data extracted from the second sample of secondary school students (N=1200) using IBM-AMOS Version 23.0. The Maximum-likelihood estimation was used in the analysis. $\chi 2/df$, comparative fit index (CFI), and Tucker-Lewis's index (TLI) were used to evaluate the goodness of fit. Both the CFI and TLI values should be greater than >.90 (Kim. 2016). In contrast, the badness of the model fit was evaluated using the root mean square error of approximation (RMSEA), whose value should be <.08 (Sun, 2005).

Figure (3) and Table (4) represent the results of the Confirmatory factor analysis:

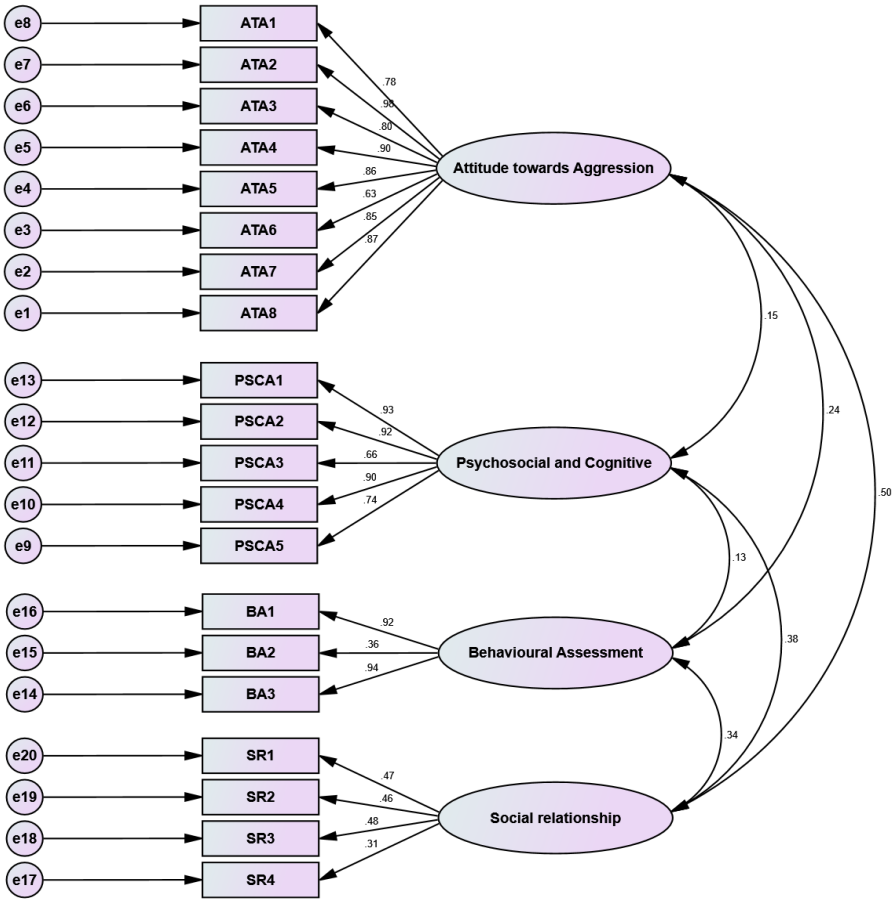

Figure 3: *Confirmatory factor Analysis*

Note: Four factors model of aggression scale. ATA, Attitude towards aggression; PSCA, Psychosocial & cognitive assessment; BA, Behavioural assessment; SR, Social relationship.

Table 4 *Goodness-of-fit index*

χ2	df	P	CMIN/DF	CFI	TLI	RMSEA
306.67	164	.000	1.87	.979	.976	.042

Note: df, degree of freedom; CFI, comparative fit index; TLI. Tucker-Lewis's index; RMSEA, root mean square error of approximation.

The model fit indices of the scale are adequate (RMSEA=0.042) or somewhat less than the values that indicate a good fit (CFI=0.97, TLI= 0.97).

Validity Assessment

Since CFA is used to evaluate construct validity, Campbell and Fiske (1959) also suggested to estimate convergence and discriminant validity to identify the structure of a measuring tool. The validity of the tool was measured through two types: i) Convergent validity and ii) Divergent validity.

Convergent validity estimation

The investigator examined the average variance extracted (AVE) and composite reliability (CR) criterion as suggested by Fornell-Larcker (1981) to determine the items' convergent validity. A value of 0.70 or above is considered acceptable for the CR, and a value of 0.70 or above is considered acceptable for the AVE; however, a value of 0.50 or above is sufficient for AVE (Mustafa, 2020). Table 5 presents the estimated values of average variance extracted (AVE) and composite reliability (CR).

Table 5: *Average variance extracted and composite reliability of the scale*

Factors	AVE	CR
Attitude towards Aggression	0.71	0.98
Psychosocial and Cognitive Assessment	0.74	0.99
Behavioural Assessment	0.66	0.97
Social Relationship	0.55	0.90

Note: AVE, Average variance extracted; CR, Composite reliability

Divergent validity estimation:

It is estimated by finding out the inter-factor correlation. If the value is less than 0.70, it means that each factor represents a distinct construct. In other words, low correlation among the factors provides evidence that the factors are not related to each other and discriminate between different constructs (Abd Elhafeez, 2022). Table 6 describes the coefficient of correlation among factors, and all the factors are below the touchstone criterion. It means the test possesses good divergent validity.

Table 6: *Correlation matrix between factors*

Factors	1	2	3	4
Attitude towards Aggression	**1**	**-**	**-**	**-**
Psychosocial & Cognitive Assessment	**.43**	**1**	**-**	**-**
Behavioural Assessment	**.24**	**.13**	**1**	**-**
Social Relationship	**.31**	**.24**	**.26**	**1**

Reliability of the Scale

The term reliability refers to the degree to which the outcomes of repeated measurements remain consistent (Glasser et al., 1990). The consistency or dependability of a measuring approach is referred to as reliability, and it refers to the consistency or stability of the score obtained from a measure or evaluation throughout time and across situations or settings (Marczyk and others 2010). The reliability of the scale was established by computing the Alpha Cronbach Coefficient. The reliability coefficient of the scale is given in the following table (7):

Table 7: *Reliability of the scale*

Alpha Cronbach Coefficient	
Total No of Items	**Cronbach Alpha**
20	.89

The above table demonstrates that the value of the reliability coefficient of the whole scale is .89, which indicates that the scale has good reliability.

Final format of the Scale

The final format of the tool consists of four dimensions with 20 items (both positive and negative) as shown in the given below table (8) and figure (4):

Table 8: *Dimensions and No. of items*

Dimensions	**No. of items in the scale**	**Total**
Attitude towards Aggression	**1-8**	**8**
Psychosocial and cognitive assessment	**9-13**	**5**
Behavioural Assessment	**14-16**	**3**
Social relationship	**17-20**	**4**
Total		**20**

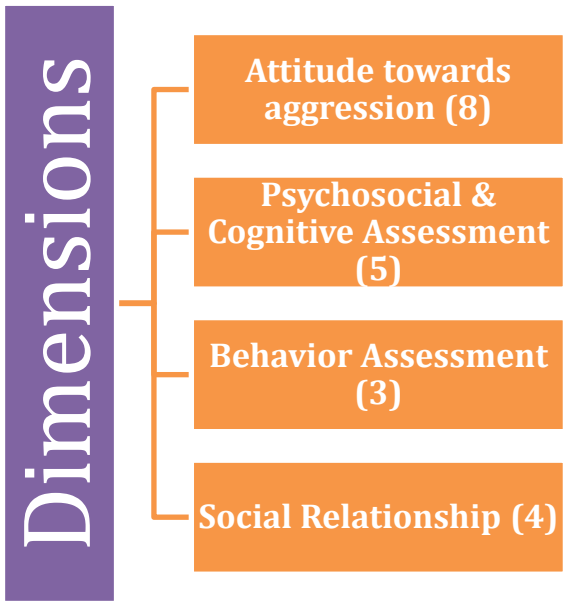

Figure 4: *Final Format of the Scale*

Administration and Scoring

The scale intends to measure aggression among secondary school students with respect to four different dimensions as stated in the above section. In this scale, the total number of positive items is 10 and negative items are 10 respectively. The maximum score on the scale is expected to be 60 and the minimum score is 20.

Norms of the Scale

The scale was administered to 1200 secondary school students for establishing norms for the interpretation of scores obtained from the scale. The researchers have followed two criteria to interpret the raw scores (Miller and others, 2009): a) transforming the raw score into the standard score (Z- Score), and b) interpretation using a normal probability curve. The following is a description of the procedure:

a) Z-scores Norms

A z-score reveals a student's relative position in terms of standard deviation unit above or below the mean score of the group. For converting raw score (obtained score) to standard score (z-score), the following descriptive metrics have been used by the researchers:

Table 10: *Z-scores Norms*

N	Mean	SEM	SD	Median	Mode	Skewness	Kurtosis
1200	43.21	.186	6.43	43	44	1.57	-0.75

In order to calculate the z-score, following formula can be used:

$$Z = \frac{X - M}{SD}$$

(Miller and others, 2009)

Where, **Z** = Standard score

X = any raw Score

M = mean of raw scores

SD = Standard deviation of raw score

A positive z-score means the acquired score is higher than the group mean score, whereas a negative z-score means the acquired score is lower than the group mean score.

The standard score norm Table (Z- Scores) of the Aggression scale is shown below:

Table 11: *Z-Score for the range (27 – 60) of obtained scores in Aggression Scale*

Raw Score	Z- Score	Z-Tabled Value	Percentage (%)
27	-2.51	.0060	00.6
28	-2.36	.0091	00.9
29	-2.20	.013	001.3
30	-2.05	.0202	2.02
31	-1.89	.0294	2.94
32	-1.74	.0409	4.09
33	-1.58	.0571	5.71
34	-1.43	.0764	7.64
35	-1.27	.1020	10.20

36	-1.12	.1314	13.14
37	-.964	.1685	16.85
38	-.809	.1867	18.67
39	-.654	.2578	25.78
40	-.498	.3121	31.21
41	-.343	.3669	36.69
42	-.187	.4286	42.86
43	-.032	.4880	48.80
44	.122	.5478	54.78
45	.278	.6064	60.64
46	.433	.6664	66.64
47	.588	.7190	71.90
48	.744	.7704	77.04
49	.899	.8133	81.33
50	1.05	.8531	85.31
51	1.21	.8869	88.69
52	1.36	.9131	91.31
53	1.52	.9357	93.57
54	1.67	.9525	95.25
55	1.83	.9664	96.64
56	1.98	.9761	97.61
57	2.14	.9838	98.38
58	2.29	.9890	98.90
59	2.45	.9929	99.29
60	2.60	.9953	99.53

1.1.1.1 Norms of Normal Probability Curve

The researchers have established the range of acquired scores (raw scores) based on the mean and standard deviation of group scores (Mean $\pm$ **1** SD) according to the normal probability curve in order to categorize the learners into different levels of aggression (Miller and others, 2009). The different levels of aggression are shown in following table (12):

Table 12: *Levels of Aggression*

S. No	Range	Level of Aggression
1	50 & above	High
2	36-49	Average

3	35 & below	Low

Conclusion:

The present research is an attempt to construct and validate an aggression scale (AS) for secondary school students. Since the principal aim of this study is to construct and validate the aggression scale, it has also been translated into Hindi language and the separate content validity for the Hindi version was also established with the help of researchers, professors, and experts from different universities of India. It has been found through the detailed analysis that the aggression scale (AS), is reliable and valid. The preceding discussion must be reviewed in light of many limitations on the applicability of the results. Because all of the respondents were secondary school students, the findings must be extended to the larger population, which includes persons with less education and socioeconomic status. The results of the present scale led researchers to the conclusion that all forms and indications that exist may reflect aggression.

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