

Construction and Standardization of a Tool to assess Cognitive Styles of Adolescent Students

Pushpa Adhikari

Research scholar, Soban Singh Jeena University, Almora

Abstract—

The performance of an individual in any field can be predicted according to their cognitive style. The study's primary purpose was to develop and standardize an assessment instrument for teenagers' cognitive styles. The researcher conducted a pilot study with a sample of 150 tribal and non-tribal adolescent students to validate the instrument and undertake item analysis. The sample was selected randomly from the government Schools of Udham Singh Nagar district of Uttarakhand. Cronbach's alpha was used in the second sample of 120 tribal and non-tribal adolescents to determine the instrument's reliability. 0.79 was the value of Cronbach's alpha. Face validity and content validity have been established for the instrument. The researcher generated z-score standards for the tool to explain the results. The final version of the cognitive style inventory has fifty items.

IndexTerms—Cognitive styles, Item analysis, Reliability, Validity, and Norms

I. INTRODUCTION

Several types of research have been carried out to have a better knowledge of the educational process. Much of the research has focused on the personal traits of students and teachers. Cognitive styles have recently been a major concern since they impact various sectors of study, including education, psychology, sociology, personality, business, and the virtual environment. Among others, Cognitive styles appear to offer a lot of potential for use in educational settings (Witkin, Moore, Goodenough and Cox,1997). Cognitive psychologists coined the term "cognitive style" while studying problem-solving, sensory, and perceptual abilities. Witkin (1950) introduced the term "cognitive style" to describe how people constantly display stylistic choices in how they arrange stimuli and construct meanings for themselves. Cognitive styles are a concept made up of numerous components of differential psychology that are linked to learner differences and the process of obtaining environmental knowledge. The consistency of an individual's cognitive functioning, such as problem-solving, decision-making, cognitive control, perception, learning, and thinking, is called cognitive style (Messick,1984). It is essential to understand the term cognition before moving on to the idea of cognitive style because cognition is the only way to obtain information from the environment. Generally, cognition is the capacity to know and to have knowledge. Cognition is the process, through which sensory inputs are transformed, reduced, elaborated, stored, recovered, and used (Neisser, 1967). Cognition includes many processes: sensory registration, perception, appraisal, selection making, memory, learning, idea-making, perceptual organisation, language, and several others. (Corr, 2010). The main steps of cognition are sensing, attending, perceiving, comprehending, understanding, and remembering.

The term "style" is used in a variety of contexts, including high-street fashion, the arts, and the media, as well as a variety of academic subjects. It has been applied to a variety of areas in psychology, including personality, communication, motivation, perception, etc. A style is a habitual pattern or preferred manner of doing something (thinking, learning, teaching, etc.) that is constant through time and across a wide range of activities. (Sternberg & Zhang, 2001). According to Webster's dictionary, published in 1967, "a style is a distinctive or distinguishing manner or method of acting or performing." Allport (1937), the first psychologist, coined the term "style" to describe a method of recognising various personality types or behavioural patterns. While styles and abilities are frequently misunderstood, there is a distinction between the two. Abilities refer to a person's ability to perform any task competently or demonstrate their experience in dealing with any situation. According to Sternberg and Zhang (2001), abilities refer to the things that an individual is capable of doing, such as performing a skill or skill combination (strategies). Styles refer to individual preferences about the application of abilities. Cognitive style refers to the distinctive way an individual processes information. Cognitive styles have a tremendous impact on pupils and the teaching-learning process. Numerous research in India and other nations have examined the influence of cognitive styles on students and the teaching-learning process. Pannu (2010) sought to explain how cognitive styles, personality variables, and adolescent adjustment influence academic achievement. 1246 senior secondary students from the Amritsar district participated in the study. The data suggest that teenagers' cognitive styles influence their academic performance. The objective of the same study undertaken by Musya (2015) in Kenya was to examine the cognitive styles and academic achievement of secondary school pupils in Kenya. The researcher reported that Cognitive styles have a significant impact on students' academic performance.

The researchers have attempted to construct the Cognitive Style Inventory to assess various dimensions of the cognitive task. Since 1940, various studies have contributed to the emergence of cognitive style models. The major problem is that the researchers generated an extensive list of cognitive styles. Some studies try to combine existing models of style into a single theory with a limited number of main dimensions, like Allinson and Hayes (1996) and, Curry (1983), Riding and Cheema (1991). Others try to develop a completely new theory of style (e.g.Sternberg, 1997). Although the literature identifies several dimensions of cognitive style, the researcher included four in the inventory after discussing them with the supervisor and subject experts. Individuals have ingrained approaches to tasks and situations associated with specific cognitive process patterns, such as Decision-making, Problem-solving, Perception, and attention (Bandall, Galpin, Marrow, and Cassidy,2016). This inventory contains fifty items that represent four dimensions of cognitive styles. In this study, the researcher includes four cognitive functions: problem-solving, locus of control, decision-making, and perception. Cognitive styles related to these cognitive functions are a systematic and intuitive style of problem-solving, internal and external locus of control, adaptive and innovative way of decision making, and field-independent and

field-dependent style of perception. The rationale for the above cognitive styles has been taken from the work of the following psychologist: Martin's systematic and intuitive cognitive styles (1983), Kriton's Adaptive and Innovative Styles (1976), Rotter's Locus of Control (1966), Witkin's field-dependent and field-independent cognitive styles (1962). This inventory has gone under the standardization process, and the reliability and validity of this inventory have been established.

II. OBJECTIVES OF THE STUDY

1. To construct a tool to assess the cognitive style among adolescents.
2. To carry out item analysis of a preliminary draft of the cognitive style scale.
3. To estimate the reliability of the scale for assessing the cognitive style among adolescent students.
4. To check the validity of the scale for assessing the cognitive styles among adolescents.
5. To establish norms for interpreting scores obtained on a scale for assessing the cognitive style of adolescents.

III. SELECTION AND WRITING OF THE ITEMS

The initial pool of the items was framed based on the previously available tool and through the review of related literature on cognitive styles. A group 100 of adolescents and their respective teachers has been interviewed. Through this procedure, the researcher has framed a form of 110 items divided into four bipolar dimensions. This form was evaluated and rated by the experts of the Department of Education S.S.J. Campus Almora, Kumauni University Nainital and the Department of Education M.B.P.G. College Haldwani. The items were rated on a five-point scale, and the researcher included only those statements in the draft which were rated as 4 or 5. The researcher has excluded all other items. In this way, the new draft consists of 76 items.

IV. ITEM VALIDATION

For item validation, the researcher goes through the item analysis process. The present form, consisting of 76 statements, was administered to a randomly selected sample of 150 tribal and non-tribal adolescent students studying in class's 11th and 12th Udham Singh Nagar District, Uttarakhand. The items were kept on a 5-point scale from Completely disagree, Disagree, Indefinite, Agree, and Completely agree. The positive statement was scored in ascending order, for instance, 1,2,3,4,5 respectively, and the negative statement was scored 5,4,3,2,1. The researcher calculated the t-test to compare the highest and lowest scorers. Scores of the top 35 and the lowest 35 students were compared through a t-test, and only those items were selected that showed significant differences between the high and low achievers. 26 items were rejected through this item analysis process. The final draft consists of 50 items. The results of the Item analysis have been attached in appendix 1.

V. STANDARDISATION OF THE TOOL

In order to generalise the outcome of any data, the instrument must be standardized. Standardization refers to the systematic and uniform administration and grading of an instrument. A standardized test is a test that is administered, scored and interpreted in a standard manner (Reynolds, Livingston, and Willson 2011). A standardized instrument must be accurate and valid and establish criteria for evaluating data.

VI. NORMALITY OF THE DATA

Normality of data is a condition for a large number of parametric statistical tests, including correlation, t-test, and analysis of variance. Additionally, z-score norms make the assumption that the data should be normally distributed. There are numerous ways for determining normality, including the Shapiro-Wilk test, the Kolmogorov-Smirnov test, Skewness, Kurtosis, histogram, box plot, P-P plot, Q-Q plot, and mean with standard deviation. Due to the large sample size of 120, the researchers employed the Kolmogorov-Smirnov test to determine normality. The P-value of the Kolmogorov - Smirnov test was 0.200 which was larger than 0.05 suggesting that the data was normally distributed. Skewness quantifies the data's symmetry, while kurtosis quantifies its peakedness. If the skewness value is between -2 and +2, and the kurtosis value is between -7 and +7, the data is considered normal (Hair, et al,2010). The data had a skewness of 0.85 and a kurtosis of 0.45, respectively. Additionally, it implies that the data were distributed normally.

VII. RELIABILITY

In simplest terms, in the context of measurement, reliability refers to the consistency or stability of assessment results (Reynolds, Livingston, and Willson 2011). To assess the reliability of the tool, it was administered to a randomly selected sample of 120 adolescent students of Udham Singh Nagar. The researcher calculated Cronbach's alpha to check the reliability of the tool. The coefficient of internal continuity was primarily tested using Cronbach's alpha. The tool calculated Cronbach's alpha. 79. dimensionwise alpha values are given in Table 1

Table-1

S. No.	Dimension of style inventory	'r'
1	Locus of control	0.74

2	Systematic and intuitive cognitive style	0.75
3	Adaptive and innovative cognitive style	0.72
4	Field-dependent and Field-Independent cognitive style	0.70
Total scores on cognitive style inventory		0.79

VIII. VALIDITY

Validity is the most crucial aspect of a test. When a test assesses the construct that it is supposed to measure, the test is considered valid. In the absence of a comparable instrument on cognitive styles, the researcher validated the instrument based on face and content validity criteria. Experts from the Department of Education and Psychology, S.S.J. Campus, Almora, and M.B. P. G. College Haldwani, Kumaun University Nainital examined the items. The final version of the Cognitive Style Inventory contains just the items allocated four or five points on the five-point rating scale and evaluated by the experts. The experts validated fifty items for inclusion in the final version of the Cognitive style inventory.

IX. NORMS

This cognitive style inventory consists of bipolar dimensions. Responses of the students are to be mentioned on a five-point Likert scale. High and low scores on the scale represent different poles of cognitive styles. To form the norms for the tool, the tool was administered by the researcher to a randomly selected sample of 120 tribal and non-tribal adolescent students. 'Z' scores were calculated from the obtained raw score of the students to identify the type of their cognitive styles. Z's score identified five different categories (very high, high, average, low, and very low) on cognitive style, which were further categorised into three separate sections representing the continuum of cognitive style. Very high scores and high scores represent Internal locus of control, Systematic, Innovative, and Field Independent cognitive styles. The average score represents the Integrated cognitive style. The low and very low scores represent the external locus of control, Intuitive, Adaptive, and Field Dependent cognitive style.

Table 2
Z-Score Norms for Total Score on Cognitive Style

S. No.	Raw Score	Z Score	Scores on Cognitive Style
1	209 to above	+1.95 and above	Very high
2	189 to below 209	+0.84 to below +1.95	High
3	169 to below 189	-0.27 to below +0.84	Average
4	150 to below 169	-1.38 to below -0.27	Low
5	Below 150	Below -1.38	Very low

X. SCORING

This cognitive inventory consists of 4 bipolar dimensions. Scoring was done on the prescribed Likert scale. Five options have been given to each statement completely disagree, Disagree, Indefinite, Agree, and completely agree. The questionnaire was scored by scoring the continuum as per the nature of the statement which is mentioned as follows:

Table 3

Scoring procedure for the statements

	Positive statement	Negative statement
Completely disagree	1	5
Disagree	2	4
Indefinite	3	3
Agree	4	2
Completely agree.	5	1

XI. NATURE OF ITEMS IN THE FINAL DRAFT

Table 4
Nature of the statements in the Cognitive Style Inventory

S.N	Dimension	Nature of Item	Item No.
1	Internal vs. External Locus of control	Positive Items	1,3,7,12,14,
		Negative Items	2,4,5,6,8,9,10,11,13,15,16
2	Systematic vs. Intuitive style	Positive Items	17,20,22,23,24,25,29,30,32,33
		Negative Items	18,19,21,26,27,28,31
3	Adaptive vs. Innovative style	Positive Items	37,38,42,43
		Negative Items	34,35,36,39,40,41,
4	Field dependent vs. Field Independent	Positive Items	44,45,47,49,50
		Negative Items	46,48

XII. CONCLUSION

Cognitive styles are a combination of stable attitudes, preferences, and habitual strategies that determine a person's way of perceiving, remembering, thinking, and problem-solving (Saracho, 1997). While cognitive style is now well-known and a research subject, its application and relevance to educational practices can assist students and teachers in achieving the targeted educational activity objectives (Bakar, & Ali, 2013). Therefore, this instrument of the cognitive styles of the tribal and non-tribal adolescents will be useful for students, teachers, and parents in recognising the cognitive styles of students and in counselling the adolescents.

References

- [1] Allinson, C. W., & Hayes, J. (1996). The cognitive style index: A measure of intuition-analysis for organisational research. *Journal of Management Studies*, 33(1), 119-135
- [2] BAKAR, Z. A., & ALI, R. (2013). COGNITIVE STYLES IN STUDENTS' LEARNING AND QUALITY EDUCATION: AN EXPLORATION OF THE FUNDAMENTAL ISSUES UNDERPINNING. 2ND INTERNATIONAL SEMINAR ON QUALITY AND AFFORDABLE EDUCATION (ISQAE 2013) (PP. 536-541).
- [3] Bendall, RCA, Galpin, A., Marrow, LP, and Cassidy (2016). Cognitive style: time to experiment. *Front.psychology*7:1786.Doi 10.3389/fpsyg.2016.01786
- [4] Corr, P.J.(2010). Individual differences in cognition. In A.Gruszka, G.Matthews and B.Szymura(Eds.) *Handbook of Individual Difference in Cognition*(pp.3-25). Springer New York, Dordrecht Heidelberg London. DOI 10.1007/978-1-4419-1210-7.
- [5] Hair, J., Black, W.C., Babin, B.J. and Anderson, R.E. (2010). *Multivariate data analysis* (7th ed.). Upper Saddle River, New Jersey: Pearson Education International.
- [6] Kirton, M. (1976). Adaptors and innovators: A description and measure. *Journal of Applied Psychology*, 61(5), 622–629. <https://doi.org/10.1037/0021-9010.61.5.622>
- [7] Martin, L. P. (1998). The cognitive-style inventory. *The Pfeiffer Library*, 8(2), 1-18.
- [8] Messick, S. (1984). The nature of cognitive styles: Problems and promises in educational practice. *Educational psychologist*, 19(2), 59-74.
- [9] Musya, M. N. (2015). *Cognitive styles and academic achievement among secondary school learners in Kenya* (Doctoral dissertation, University of Nairobi).
- [10] Neisser, U. (1967). *Cognitive Psychology*. New York: Appleton-Century Crofts.
- [11] Pannu, R. (2010). A study of academic achievement in relation to cognitive styles, personality traits and adjustment of adolescents. PhD thesis, Department of Education, Guru Nanak Dev University. <http://hdl.handle.net/10603/7060>
- [12] Reynolds, C.R., Livingston, R.B., and Willson, V. (2011). *Measurement and Assessment in Education*. PHI Learning, New Delhi.
- [13] Rotter, Julian B. (1966). Generalised expectancies for internal versus external control of reinforcement.., 80(1), 1–28. doi:10.1037/h0092976
- [14] Saracho, O. N. (1997). Teachers' and Students' Cognitive Styles in Early Childhood Education. Bergin & Garvey, 88 Post Road West, Box 5007, Westport, CT 06881.
- [15] Sternberg, R. J., & Zhang, L. F. (Eds.). (2001). *Perspectives on thinking, learning, and cognitive styles*. Routledge.
- [16] Witkin, H. A., Dyk, R. B., Fattuson, H. F., Goodenough, D. R., & Karp, S. A. (1962). Psychological differentiation: Studies of development.

Appendix 1
't' values of the items in the Item Analysis process

Item Numbers	t' value	Item selected	Item rejected	Item Numbers	t' value	Item selected	Item rejected
1	2.13	Selected		39	3.62	Selected	
2	2.93	Selected		40	2.34	Selected	
3	2.638	Selected		41	4.81	Selected	
4	0.803	Rejected	1	42	2.9	Selected	
5	0.829	Rejected	2	43	2.69	Selected	
6	2.855	Selected		44	3.16	Selected	
7	4.218	Selected		45	3.39	Selected	
8	1.907	Selected		46	1.27	Rejected	11
9	0.75	Rejected	3	47	3.67	Selected	
10	2.081	Selected		48	2.72	Selected	
11	4.311	Selected		49	-0.83	Rejected	12
12	5.066	Selected		50	0	Rejected	13
13	2.24	Selected		51	1.11	Rejected	14
14	0.5	Rejected	4	52	2.38	Selected	
15	3.1486	Selected		53	0.24	Rejected	15
16	0.268	Rejected	5	54	2.56	Selected	
17	3.31	Selected		55	1.19	Rejected	16
18	2.809	Selected		56	0	Rejected	17
19	3.44	Selected		57	2.22	Selected	
20	3.09	Selected		58	-0.54	Rejected	18
21	2.009	Selected		59	-0.64	Rejected	19
22	1.15	Rejected	6	60	1.3	Rejected	20
23	0.85	Rejected	7	61	-1.83	Rejected	21
24	3.775	Selected		62	3.26	Selected	
25	1.951	Selected		63	0.97	Rejected	22
26	3.13	Selected		64	0.1	Rejected	23
27	2.95	Selected		65	2.99	Selected	
28	-57	Rejected	8	66	-0.58	Rejected	24
29	-0.69	Rejected	9	67	1.97	Selected	
30	2.91	Selected		68	2.28	Selected	
31	2.48	Selected		69	0.53	Rejected	25
32	4.42	Selected		70	1.98	Selected	
33	3.66	Selected		71	2.1	Selected	
34	0.8	Rejected	10	72	2.79	Selected	
35	2.54	Selected		73	-10	Rejected	26
36	4.66	Selected		74	2.38	Selected	
37	2.61	Selected		75	2.81	Selected	
38	3.622	Selected		76	2.5	Selected	