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CONSTRUCTION AND STANDARDIZATION OF SCIENTIFIC VALUE SCALE FOR MIDDLE SCHOOL LEVEL

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ABSTRACT:
The aim of this study is to develop and standardization of scientific value scale for middle school level of teaching. The research was carried out with 30 subject expert, 10 Educationist and 500 students of CBSE board studying at 6-10 grades. The study consists of five parts including literature review, item pool, expert's opinions, administration of scale, computing the reliability and validity. While constituting the item pool, an intensive study of literature and theories available in relation to scientific value was thoroughly studied for establishing dimensions, an interview was carried out with subject experts for preparing items, teaching science at middle school level. Previously 45 items was constructed and prepared draft was given to a panel of judge. On the basis of expert decision 20 items were deleted and the items, which are directly related with the subject of scientific value or which are selected from the relevant interviews. 25 of them were edited by expert opinions on the five point Likert type. . The draft scale was administered to 500 students of CBSE board studying Science at 6-10th grade level. As a result of factor analysis, the number of items was reduced to 20. After carrying out factor analysis the Cronbach-Alpha internal integrity coefficient of the final version of the scale was found as 0.702. A split half reliability coefficient was computed for the entire group of students and for split half reliability to the correlation coefficient yields a reliability coefficient of .781. By computing the reliability of SVS, the scale was ready to be used.

INTRODUCTION:
Research in Science education at Primary and secondary levels in recent years have focused more on concept learning or understanding than on skills and values development. The teaching of Science for scientific literacy and science culture in a given society is a priority thrust in science education. UNESCO has led international efforts towards scientific literacy, particularly, in developing countries, cognizant of the crucial role of science and technology in national development. Science plays perhaps the most important role in the understanding the universe. Science moreover contributes to the formation of values that effect social values. Therefore, there are many important characteristics and values that must be considered in scientific activities. Scientific values matters the most above anything present on universe. It defines everything with scientific explanation scientific values include honesty readiness to admit failures, curiosity, risk taking objectivity, precision, confidence ,responsibility ,Respect for the view of others , Being open –minded , Belief in cause and effect, curiosity and imagination, other scientific values are reliability, testability, accuracy, precision,

generality, simplicity of concepts and heuristic power, open mindedness means ready acceptance of often new suggestions , ideas, influences, or opinions.

The values of science derive neither from the virtues of its members, nor from the finger-wagging codes of conduct by which every profession reminds itself to be good. They have grown out of the practice of science, because they are the conditions for its practice.

Science is the creation of concepts and their exploration in the facts. It has no other test of truth than its empirical truth to fact. Truth is the drive at the center of science; it must have the habit of truth, not as a dogma but as a process. Consider then, step by step, what kind of society scientists have been compelled to form in this single pursuit. If truth is to be found, not given, and if therefore it is to be tested in action, what other conditions (and with them, what other values) grow of themselves from this?

In science, there is no substitute for independence. Today we find is as natural to prize originality in a child's drawing and an arrangement of flowers as in an invention. Science has bred the love of originality as a mark of independence. Independence, originality, and therefore dissent: these words show the progress, they stamp the character of our civilization.

REVIEW OF RELATED LITERATURE:

In 1942 Robert Merton set out to describe the norms governing scientific institutions. He listed:

a) "Universalism" (scientific contributions should not be judged on the basis of the race, religion, national origin, etc. of the scientist)

b) Disinterestedness (science should not serve a particular social/political agenda)

c) Communality (scientific results should be freely shared)

d) Organized skepticism

Other proximate or mediating values that promote the ultimate goal of reliable knowledge involve methods of evaluating knowledge claims. These epistemic values include controlled observation, inventive experiments, confirmation of predictions, repeatability and, frequently, statistical analysis.

Rescher 1969, Many medical technologies allow us to express our values in preserving life and health. At the same time, however, they can bring other values into consideration. With the advent of hemodialysis and organ transplants, for example, their limited availability combined with the existing value of fairness in generating a new problem: ensuring fair access to treatment. Subsequently, ethicists developed new solutions for allocating scarce medical resources.

Des Jardins 1993; Newton and Dillingham 1994 ,Similarly, ecological knowledge--say, about pesticides, heavy metals, toxic chemicals and other pollutants--has reduced conventional values about prudence and respect for life in reshaping our values about waste, consumption, modes of production and our relationship to the environment.

Freedman Benjamin (1987) A good touchstone for justifying an ethical value (as it is in science) is a good critic: reasons must be strong enough and draw on principles general enough to convince someone with a skeptical or opposing perspective. Ethics, no less than science, aims at objectivity. Is science value neutral? The explicit teaching of values in science is rare. .

Allchin, 1998, indeed, a diversity of values promotes more robust knowledge where they intersect. Second, values can be equally objective when they require communal justification and must thereby be based on generally accepted principles. In what follows, I survey broadly the relation of science and values, sample

important recent findings in the history, philosophy and sociology of science, and suggest generally how to address these issues.

Koertge , 2005, Scientific values :The sense of human dignity. It is alliterating that takes us from the similarities between great art and great science to the practice of knowing and science's great gift to the ways in which these things have shaped our society.

Glynn and Koballa (2006) , Attitudes towards Science has been viewed as an instrument that can aid development in many countries. It lays important and dominant roles in spearheading technological advancement, promoting national wealth, improving health, and accelerating industrialization.

A BRIEF LOOK AT SOCIOLOGICAL ACCOUNTS OF SCIENTIFIC VALUES:

A good starting point is Talcott Parson's list of four basic desiderata for scientific knowledge:

a) Logical clarity or precision

b) Logical consistency among claims

c) Generality of principles

d) Empirical validity

Science is a communal effort – everyone builds on the common body of knowledge. Hull identifies three factors crucial to the scientific process: curiosity, credit and checking.

Values intersect with science in three primary ways. First, there are values, particularly epistemic values, which guide scientific research itself. Second, the scientific enterprise is always embedded in some particular culture and values enter science through its individual practitioners, whether consciously or not. Finally, values emerge from science, both as a product and process, and may be redistributed more broadly in the culture or society. Also, scientific discoveries may pose new social challenges about values, though the values themselves may be conventional. Several questions help guide disciplined inquiry into ethics and values.

A fundamental feature of science, as conceived by most scientists, is that it deals with facts, not values. Further, science is objective, while values are not. These benchmarks can offer great comfort to scientists, who often see themselves as working in the privileged domain of certain and permanent knowledge. Such views of science are also closely allied in the public sphere with the authority of scientists and the powerful imprimatur of evidence as "scientific". Recently, however, sociologists of science, among others, have challenged the notion of science as value-free and thereby raised questions--especially important for emerging scientists--about the authority of science and its methods. The popular conceptions--both that science is value-free and that objectivity is best exemplified by scientific fact--are overstated and misleading. This does not oblige us, however, to abandon science or objectivity, or to embrace an uneasy relativism. First, science does express a wealth of epistemic values and inevitably incorporates cultural values in practice. But this need not be a threat: some values in science govern how we regulate the potentially biasing effect of other values in producing reliable knowledge.

The most dramatic social influence of scientific values, however, may be the image of science itself as a model for all problem-solving. Science (or technology) is sometimes viewed, first, as the panacea for all social problems and, second, as the exclusive or primary means for objectivity, even where other values are involved. Not all problems are amenable to scientific approaches, however, and a narrowly scientific or "technocratic" view can forestall solving problems in the appropriate realm. A "scientific" approach to

solving global warming, for example, might easily focus on cost-effective means of reducing greenhouse gas emissions, diverting attention away from the historical sources of the problem and the ethical need for accountability and remedial justice. One task in teaching is clearly to articulate the limited domain of scientific values and how they integrate with other values.

Finally, scientific knowledge and new technologies can introduce new ethical or social problems, based on preexisting values. Science does not create these new values. Rather, it introduces novel situations which require us to apply old values in significantly new ways. Awareness that scientific research is typically coupled with new concerns about ethics and values was reflected, for example, in decisions to couple the human genome initiative with funding of research on the humanistic implications of the project.

Values have been perceived as a nuisance because they prevent inquiry, Observing, communicating, comparing, organizing, relating, inferring, and applying: These are skills meant to be value free.

Values:objectivity, accuracy, precision ,pursuit of truth, problem solving, regard for human significance ,protect human life: safety and risks, intellectual, honesty, academic honesty, courage ,humility ,decision-making, willingness to suspend judgment, scientific inquiry: being fair and just ,questioning of all things ,demand for verification respect for logic ,integrity, diligence ,persistence ,curiosity ,open-mindedness critical evaluation of alternatives ,imagination

NEGATIVE VALUES:

misuse of science de-humanizing people individualism and competition to the detriment of the global environment

HIDDEN VALUES:

cultural biases , disrespectful interaction between teacher and student treatment of student opinions in a disrespectful way , cooperation and teamwork, respect for life, respect for the environment respect for natural laws; using them for good,

METHODS OF TEACHING CHARACTER EDUCATION IN SCIENCE:

Inculcate , Develop, Clarify Values in conflict: diversity of perspectives.

NEED OF DEVELOPING SVS (SCIENTIFIC VALUE SCALE):

PURPOSE OF SCIENCE:

Science is critical to sustaining, maintaining and improving the quality of life on earth for the future and for enhancing democratic societies and the global economy. The goal of science education is not only to produce scientists, but also to prepare well rounded, clear thinking, scientifically literate citizens. Helping young people acquire the knowledge, skills and values they will need as productive adults in an increasingly technological society is the major purpose for science instruction. "Science is practiced in the context of human culture, and therefore, dynamic interactions occur among science, technology, and society." Present day science rarely aims to teach values in any direct or explicit sense, yet values are inescapably transmitted in science lessons.

ROLE OF SCIENTIFIC ATTITUDE IN DEVELOPING SCIENTIFIC VALUE:

Scientific attitude is the way to respond or involve in a phenomenon in scientific manner .it is the way to react in certain manner including scientific thinking while the attitude towards science is the attitude of a children towards opting science as a subjects like others maths, social sciences etc.It may be positive or negative. A person, who posse's scientific attitude tries to be objective and see different sides of an issue, s/he does not make rash conclusions, judgments or decisions. S/he is willing to listen to the opinion of the others and to study counter arguments or experimental evidences before taking action. A scientific attitude plays an important role in the formation of scientific Values.

PLANNING FOR DEVELOPING SCIENTIFIC VALUE SCALE :

The construction of scientific value scale was planned with the purpose of assessing the scientific values of students studying science at junior high school level in CBSE schools. Construction of the scale was undertaken in consultation with eminent subject's experts. This was representing the universe of content, including all factors affecting attitude towards science.

METHODOLOGY:

In the study, the tool was developed in the winter semester of 2014 academic year with the participation of 500 CBSE board schools students selected from different schools of Meerut district.

SAMPLE:

The sample of study consists of 500 CBSE board schools students studying in 6-10th grades that are chosen from different schools of Meerut district. Demographic information of the sample was given in Table 1.

Table 1.

		Frequency(f)	**Percentage(%)**
Gender	Male	265	53.00
	Female	235	47.00
Grade	VI	100	20
	VII	100	20
	VIII	100	20
	IX	100	20
	X	100	20
Intelligence	High	165	33.00
	Average	250	50.00
	Low	85	17.00
SES	High	216	43.20
	Average	182	36.40
	Low	102	20.40
Rural urban	Rural	135	27.00
	Urban	365	73.00

DEVELOPMENT PROCESS:

It was followed five stages in the development of the scale

I Stage:-At the first stage, so many scales were examined in order to determine the statement of scale and how to develop scale. A critical review of literature has done to determine the direction of scale. It was carried out by semi structured interview of 30 subject experts to determine the dimensions which can reflect the scientific values. After interview was analyzed and dimension of SVS was determine.

II Stage- At this stage the construction of items was done .After having specified the nature of items and mode of responses, the statements pertaining to each dimension indicated earlier were prepared. The prepared, item pool consists of 45 statements. These items were discussed with the eminent experts at different intervals to determine the relevance of items. During this discussion the researcher made the best efforts to improve the language, ambiguity vagueness and subjectivity found in the terms used in the scale. The items which seemed to overlap with one another were critically examined. Initially 40 items were prepared. These items were arranged serially in a random order on a five point rating scale such as "strongly disagree", "disagree", "undecided", "agree" and "strongly agree" and it was printed.

III Stage- In the third stage: for the purpose of content and construct validation, initial draft of the Scientific value scale with 45 items on a five point rating scale was given to a panel of judges, consisted of 4 Science educators, practicing scientist and 4 liberal professor of education psychology and educational measurement and evaluation for taking their opinions about whether the selected items were valid items for assessing student's scientific value. On the basis of expert decision, 25 items were deleted because they are not suitable for students' level and 6 were modified. As a conclusion, scientific value scale comprised of 20 items covering all the aspects of theory of values on five point rating scale.

IV Stage -In the fourth stage: Having received feedback from expert the final draft of the scale was prepared. As a result of factor analysis, the number of item was reduced to 20. After arranging the scale items, the next major step was that of trying them out on a group of subjects who were representative of the population for which the total score was being developed. Final draft of the scale was administered to 500 CBSE board students form grade 6-10th for calculating validity (particularly construct validity) and reliability of the Scientific value scale. Student's responses were entered an excel file created for further analyses.

V Stage-In the last stage: The data collected from 500 CBSE board students were analyzed by means of factor analysis and reliability analysis through the use of SPSS 20.Firstly, it was calculated means and standard deviations of upper 27% (237 students) and lower 27% points and t-tests between items' means of upper 27% and lower 27% points. In addition to the data were subjected to factor analysis with principle component method in order to examine the factor structure behind the scientific value scale. Reliability analysis was performed for each of the emerged sub-scales and Croanbach alpha correlation coefficients were used. Then, Croanbach alpha correlation coefficients were calculated among these factors.The scale comprised of 20 statements in all four dimensions of scientific value scale .Distribution of items and components of scientific value scale is given in the table:

Table 2
TABLE SHOWING DIMENSION WISE DISTRIBUTION OF ITEMS

	Dimension	**Number of items**
I.	**Individualistic scientific values**	1, 2, 5, 13, 15
II .	**Logical**	4, 6, 7, 19, 20
III	**Empirical**	3, 11, 12, 14, 16
IV	**Social and civic virtues**	8, 9, 10, 17, 18
	Total no. of items	20

SCORING
The SVS is scored by assigning point values to each of the attitude items, point values are assigned as shown in the table:

Table 3.

	Positive item	**Negative item**
SA (strongly agree**)**	**5**	**1**
A (Agree**)**	**4**	**2**
U (Undecided**)**	**3**	**3**
D (Disagree**)**	**2**	**4**
SD (Strongly Disagree**)**	**1**	**5**

Scale contains 4 subscales decided on the basis of Factors reflecting scientific values. Scores for various subscales can be determined by adding a total for positive items and a total for negative items.

RELIABILITY:
Croanbach alpha correlation coefficients were calculated on SPSS 20 . After carrying out factor analysis the Cronbach-Alpha internal integrity coefficient of the final version of the scale was found as 0.702. A split half reliability coefficient was computed for the entire group of students and for split half reliability to the correlation coefficient yields a reliability coefficient of .781. By computing the reliability of SVS, the scale was ready to be used. At the final step the norms for interpretation were established. Grade norms table for class 6-10th was prepared.

CONCLUSION:
Scientific values might have a positive impact on the development of civic virtues within a society the word science sometimes refers to the questions, claims, and arguments that scientists work with and at other times designates the institution dedicated to the production of that intellectual content, when people hear the words “science” and “values” in close proximity. The core values within science, not enter into a debate about the social value of science and technology. To ascribe a set of norms to the scientific community is not to assert that all scientists always act in accordance with them. However, it does imply that these values are generally evident in scientific practice.

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