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Prediction of Science Motivation and Attitude towards Science: Roles of Hobbies, Preferred Subject and Gender of Secondary School Students

***Abstract*: The objective of the investigation was to find out roles of hobbies, preferred subject and participant gender in statistical prediction of science motivation and attitude. Participants were a stratified random sample of 88 school students of grades VI to X. Tools used for data collection were a general information schedule and two standardized tests - Science Motivation Questionnaire (SMQ-2) by Glynn et al. (2011) and Test of Science-Related Attitudes (Fraser,1981). Ordinal Logistic Regression was conducted to report that the attitudinal variable Leisure Interest in Science could be predicted 20.3%, the highest among the dependent variables by predictors including hobbies.**

Keywords: Hobbies, Preferred Discipline, Gender, Science Motivation, Attitude towards Science.

A hobby is a recreational activity engaged in leisure time. Hobbies of different individuals differ not widely but somewhat unless one has an unusual hobby. Leisure time activities include hobbies[1]. Pursuit of science as pastime can be a hobby. Science is a curricular entity but an extracurricular one also. Nowadays the word extracurricular has been replaced by the word cocurricular but in the context of hobbies the word extracurricular seems appropriate. Since we are talking about enjoyment the question of liking science or disliking science comes up. The measurement of attitude towards science is nothing but the assessment of the degree of this liking or dislike. The degree of motivation is the impetus to exert oneself to do some activity including engagement in a subject of study. Liking of science signifies motivation for science. Thus, a science hobby is expected to reflect a positive attitude towards and motivation for science. A science student may have other hobbies, the roles of which in science attitude and motivation remain unexplored. This study is an exploration.

Leisure has many benefits. It reduces stress and burnout. In a study[2] it was reported that academic burnout can be dealt with, prevented and recovered from by engagement in hobbies. According to researchers[3] time spent on working activities is inversely related to study motivation, attitude, resistance and academic achievement. Such relationships were not found for leisure time engagement. It was found that learning motivation, learning satisfaction, leisure satisfaction and learning performance were positively correlated[4]. Investigators[5] found that Science hobbyists engage in self-directed, free choice science learning and many have considerable expertise in their hobby area. Similar results were reported by an investigator in India[6]. It was reported that diversity in Leisure Time Sports Activities (LTSA) is important. Individuals with higher variation in Sports Activities are more satisfied[7]. It was also reported by other investigators that leisure plays important role in health, well-being and quality of life[8].It was found and reported by researchers[9] that enjoyable leisure activities, taken in aggregate, are associated with psychosocial and physical measures relevant for health and well-being. Physical health relates to leisure activities and leisure activities were related to well-being [10]. In a study in India[11] it was found that excessive digital leisure (i.e. technology use in leisure time) has a negative impact on health of adolescents.

Contextual write-up on hobbies are not that many even more so in the Indian scenario. So, hobbies as vehicles of interest[12] have to be studied in ways that prove their presence as leisure time activities. Hobbies of individuals from childhood to late adulthood have to be studied to gauge their trend of development. For example, investigators[13] sampled 387 five- to six-year-old children. They administered their Leisure Time in Science - a pictographic scale on the children. The children were to have positive attitude towards leisure time activities in science. But their intentions to engage in these activities were far from promising as nonscientific activities were preferred. It was reported that integration of tabletop games in natural science course improved fifth graders' attention towards learning[14]. It was found that leisure interest in science was strongly related to positive attitude towards science learning for a sample of secondary school students[15]. It was reported that in urban adolescents leisure time activities involved greater use of electronic media and telecommunication appliances[16]. University students were selected to be included in a sample to report that intrinsic leisure motivation is the strongest predictor for leisure satisfaction[17]. It was found that university students' leisure

centrality has positive influence on self-satisfaction and academic intrinsic motivation[18]. That explains the close relation between leisure time engagement in science and motivation towards science learning. Investigators[19]found that leisure activities positively moderated subjective wellbeing among participant older adults with depression. However, it was deemed necessary to study the impact of types of hobbies on motivation and attitude towards science learning in secondary students. This group of participants is on the verge of entering the higher secondary stage where they may elect science as a course of study whereupon they enter tertiary stage of education in which there is scope for higher studies and research in science subjects. Preferred group of subjects appear to have influence over student motivation and attitude[20,21]. Therefore, favourite academic discipline will have a place in this investigation. There is reason to believe that science motivation, the attitude towards study of science and hobbies have a gender effect as shown by many studies[1,22-24]. So, gender will be considered as a variable in the present study.

Methodology

The foregoing review of studies led to the formulation of the following objectives of research.

Research Objectives:

(i) To find out to what extent aspects of hobbies, preferred discipline and gender of participants can account for science motivation.

(ii) To find out to what extent aspects of hobbies, preferred discipline and gender of participants can account for attitude towards science.

Null Hypotheses: (H_0 1)Hobbies, preferred discipline and gender of participants do not account for science motivation.

(H_0 2)Hobbies, preferred discipline and gender of participants do not account for attitude towards science.

Design of the Study: Non-Experimental (Correlational) Research Design was used. The predictors are hobbies, preferred discipline (Arts or Science or Combination of the two) and gender. The dependent variables are science motivation and aspects of attitude towards science of participants.

Materials: The following materials phrased in simple English were administered to participants for data collection:

i. General Information Schedule: It was prepared by the authors namely, Nandini Chatterjee and Asima Patra to collect background information including that related to hobbies of participants. It collates fourteen items with the following items related to hobbies:

Do you have any hobby?

If yes, then what is your hobby?

Do you take training for your hobby?

How many times in a week do you practice your hobby?

How many hours in a week do you practice your hobby?

Do you think practicing hobby improves your studies?

Do you believe practicing hobby consumes so much time that studies are hampered?

The scoring was done in the format provided for more informational data analysis.

ii. Science Motivation Questionnaire (SMQ-2) devised by S.M. Glynn et al. (2011): This standardised questionnaire assesses the motivation of students to study science in courses (rather than in contexts like hobbies) through twenty five statements (items). It assesses five motivation components i.e., intrinsic motivation, self-determination, self-efficacy, career motivation and grade motivation each having five items. The responses are indicated in a five-point scale. Reliability values were career motivation (0.92), intrinsic motivation (0.89) and self-determination (0.88). Factor analysis affirmed a valid structure with factor loadings ranging from high to moderate[25]. The present authors calculated the Odd-Even Reliability (Cronbach Alpha) of the entire scale and the value was .799.

iii. Test of Science-Related Attitudes (TOSRA) authored by Barry J. Fraser (1981): It has been devised to assess seven Science-Related Attitudes among school students of secondary level. These scales with ten items each are named as Science-Related Attitudes - Social Implications of Science (SRA-S), Normality of Scientists (SRA-N), Attitude to Scientific Inquiry (SRA-I), Adoption of Scientific Attitudes (SRA-A), Enjoyment of Science Lessons(SRA-E), Leisure Interest in Science (SRA-L) and Career Interest in Science (SRA-C). The test can be administered to a group at a time of

school students in the duration of a class lesson. The test has no time limit. The responses are categorised in Likert scale and scored. The psychometric properties of TOSRA were Cronbach's alpha reliability (internal consistency) values ranging from 0.64 to 0.93. Discriminant validity coefficients were between 0.10 and 0.56[26]. The Cronbach's alpha reliability (internal consistency) values calculated by the present authors ranged from 0.721 to 0.330.

Participants

The stratified random sample comprised of 88 school students of grades VI to X. Among them 44 were girls and 44 were boys. Classified further there were eight girls and eight boys of grade VI, 10 girls and 10 boys of grade VII, 10 girls and 10 boys of grade VIII, seven girls and seven boys of grade IX and nine girls and nine boys of grade X. The data were collected from one school in Bankura town (West Bengal). This was done to control school linked variables[27,28] and to avoid confounding.

Techniques of Statistical Analysis

Ordinal Logistic Regression: It was applied to find out causation of ordinal data emanating from the ranked dependent variables. Bivariate concordances between predictor and dependent variables were examined through computation of Kendall's tau c and the values were found non-significant which ruled out discussion.

Results and Discussion

Table 1 Results of Ordinal Regression-Pseudo-R-Square

Dependent Variables	Pseudo R Square		
Science motivation	.312	.330	.127
Science Related Attitude-Social Implications of Science	.261	.282	.116
Science Related Attitude-Normality of scientists	.223	.246	.105
Science Related Attitude-Attitude to inquiry	.151	.160	.056
Science Related Attitude-Adoption of scientific attitudes	.201	.216	.084
Science Related Attitude-Enjoyment of science lessons	.319	.336	.129
Science Related Attitude-Leisure interest in science	.434	.462	.203
Science Related Attitude-Career interest in science	.298	.311	.114

Outcomes of Ordinal Logistic Regression (Table 1) consist of Cox and Snell, Nagelkerke and McFadden values. These are approximations hence the name Pseudo (false) R^2. Cox and Snell's R^2 is based on the log likelihood of the model compared to a reference with less than unity for a closest estimation. The highest value of Cox and Snell is reported for Science Related Attitude – Leisure Interest in Science, a categorical dependent variable with the predictors pertaining to hobbies, preferred discipline and participant gender. The results of prior researches [3,14,24-26] are in agreement.

Nagelkerke's R^2 is an expansion on Cox and Snell so its values cover the scale from zero to unity. It shows the same trend with the highest value reported for Science Related Attitude – Leisure Interest in Science. McFadden's R^2 truly reflects estimation. It pits the intercept only model against the full estimated model (represented as Final in Table 2).

Intercept Only (Adjusted) model for the dependent variable Science Related Attitude – Leisure Interest in Science is 231.15 (Table 2) against 181.10 for the Final one. The difference between the two variances is reported as the Chi Square value of 50.05 which is significant (.000). This Chi Square value appears to be the highest of all such values reported in Table 2. If we may be permitted to quote McFadden values (Table 1), the value of .203 can be interpreted as predictors' (hobbies, preferred disciplines and gender) accounting for 20.3% variance in the dependent variable (Science Related Attitude – Leisure Interest in Science) ranks. Thus the 2nd null hypothesis is not supported for the aspect of Science Related Attitude – Leisure Interest in Science. This result is in agreement with that of previous researches[3,14,15].For the rest of the values in Table 2 the Chi Square ratios are significant but to a lesser extent for Science Related Attitude – Enjoyment of Science Lessons (Chi Square =35.81, Sig. .004), Science Motivation (Chi Square = 32.97, Sig. .005), Science Related Attitude – Career Interest in Science (Chi Square =31.08, Sig. .009) and Science Related Attitude – Social Implications of Science (Chi Square = 26.66, Sig. .032). Corresponding McFadden values (Table 1) indicate that Science Related Attitude – Enjoyment of Science Lessons was predicted 12.9%, Science Motivation was predicted 12.7%, Science Related Attitude – Social Implications of Science was predicted 11.6% and Science Related Attitude – Career Interest in Science was predicted 11.4% by hobbies, preferred discipline and participant gender. The 1st and 2nd null hypothesis are rejected in favour of their

Table 2 Results of Ordinal Regression-Model Fitting Information

Dependent Variables	Model	Model Fitting Criteria-2 log likelihood	Likelihood Ratio Tests		
			Chisquare	df	sig
Science motivation	Intercept only	248.467			
	Final	215.497	32.970	15	.005
Science Related Attitude-Social Implications of Science	Intercept only	216.182			
	Final	189.525	26.657	15	.032
Science Related Attitude-Normality of scientists	Intercept only	193.575			
	Final	171.319	22.256	15	.101
Science Related Attitude-Attitude to inquiry	Intercept only	240.562			
	Final	226.135	14.427	15	.493
Science Related Attitude-Adoption of scientific attitudes	Intercept only	220.854			
	Final	201.064	19.791	15	.180
Science Related Attitude-Enjoyment of science lessons	Intercept only	246.703			
	Final	212.889	33.814	15	.004
Science Related Attitude-Leisure interest in science	Intercept only	231.148			
	Final	181.103	50.046	15	.000
Science Related Attitude-Career interest in science	Intercept only	259.667			
	Final	228.588	31.079	15	.009

respective alternatives in these cases also. Researches[3,14,23-26] are in agreement.

Conclusion

In a way this inquiry sets the stage for further investigation into the hobby-gender conclave in Science motivation and different aspects of Attitude towards Science. This is no way a definite answer to the questions raised in the Objectives sub-section of the Methodology can be obtained. An affirmative answer is in order but further investigations with adapted versions of the standardised tools and larger as well as more representative data are needed. The research is in progress. ❐

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