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Users' Satisfaction on SC/ST Book Bank Scheme through Ordinal Logistic Regression Analysis

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Abstract

Ordinal Logistic Regression (OLR) is used to predict an ordinal structured variable given one or more independent variables. In this study, OLR used to decide the level of satisfaction on SC/ST book bank scheme (ordinal independent variable), measured on a five-point Likert type scale from “completely dissatisfied-1 through completely satisfied-5, depending on the discernment of ‘life science’ and ‘engineering students belonging to Scheduled Caste (SC) or Tribe (ST)’. Model appropriateness depends on determining which explanatory variables considered for the model and selecting the link function (complementary log-log link function used in this study). Likewise, the model fitting perceptions, the accuracy of the analysis results, and the validity of the model uncertainties, for example, the test of parallel lines, were basically evaluated for deciding on the best model. One of the principal findings was that availability of essential textbooks for free, favorable library infrastructure facilities were notably significant with the student’s opinion towards the SC/ST book bank facility. Further, respondents faced difficulties with issues such as books that were no longer circulated on time, study materials had been low standard and did not cover the syllabus.

Keywords: Satisfaction, SC/ST Book Bank, Likert scale, Ordinal Regression, Students

Introduction

The native ethnic communities of India are designated “Scheduled Tribes (ST)” in the Constitution. The term, created by the British, covers approximately 255 such groups (Catherine 2010). This idea was promptly acknowledged by the normal, educated Indian who follows his own heritage to the Aryan and Dravidian invaders of the subcontinent. Monetarily and socially least propelled, the scheduled tribes are the soonest occupants of India and most Indians think

about the innate communities, which live in confined and independent gatherings, as a distinct group socially and culturally (Khan 2018), (Vijay and Shailaja 1984). The “Scheduled Castes (SC)” are backward, it is because of their prevalent regional nature, lack of education, depend on agriculture, or different occupations with low income, and because of discrimination, mistreatment, and persecution they have been experiencing others for quite a long time (Madheshwaran 2016). Education for SC's & ST's is very essential as it seeks to bring in an effective transformation. It is only through edification, these communities can drive out ignorance and avail the privileges and facilities extended to them by the government. The scheduled tribes and castes are as a result embodied in the central parliament and state legislatures infraction to their population in every state; there are reserved service posts for them, special quotas in professional colleges and schools (Somasekhara et al 1995). The University Grants Commission (2007), on the recommendations of the eighteen member working group on student welfare programs, evinced interest in developing the library facilities, step by step on priority basis that is non-resident student centers, textbook libraries, in Arts, Commerce and Sciences, Study centers, and Book Banks. All these schemes are meant for providing essential textbooks. Under the education programs for development, several schemes were initiated by the Government for the welfare of the students from SC/ST and Backward communities. One is “The Scheme of Book Bank for SC&ST students” meant to furnish exceptional class students access to today's textual content books for medical (comprising Indian medicine and Homeopathy), veterinary, engineering, agriculture, and poly-technique courses which require highly-priced books. (Information Booklet, 2009).

Ordinal regression approach was applied in this study to demonstrate the association concerning the ordinal end result variable, for instance, students' attitude regarding the benefit of SC/ST book bank scheme in their respective libraries, and the explanatory variables concerning Life science (Medicine, Homeopathy Veterinary, and Dental courses) and Engineering discipline (Civil, Mechanical, Electrical, Electronics and Communication, Computer Science, Information Technology and Chemical). The outcome variable for students' satisfaction level was measured on an ordered, categorical, and five-point Likert scale- “Completely Dissatisfied”, “Somewhat Dissatisfied”, “Neutral”, “Somewhat Satisfied”, and “Completely Satisfied”. Ordinal regression model includes Pearson and Deviance goodness-of-fit tests; the Cox and Snell, Nagelkerke and McFadden measures of R²; and the likelihood-ratio test. Predictor variables covered 4

demographic levels, e.g., sexual category, age, organization and education, and 22 questionnaire items related to the helpfulness and difficulties faced by students for availing SC/ST book bank facilities in their respective libraries as mentioned in Figure 1. The ordinal regression strategy is permitting scientists to recognize explanatory variables related to book availing service, book exchanging facility during the semester, and essential textbooks that contribute to overall students' attitudes toward the SC/ST Book Bank facility. This study is the first of its kind exploring users' understanding belonging to diverse disciplines with the book-bank facilities provided in their libraries. The student satisfaction survey required through the thought that special category students have needs and rights to get registered in government-supported welfare schemes and to acquire responsive administrations. This user satisfaction study provides academic institutions current status of the key benefits and issues met by their students with regard to the book bank facility.

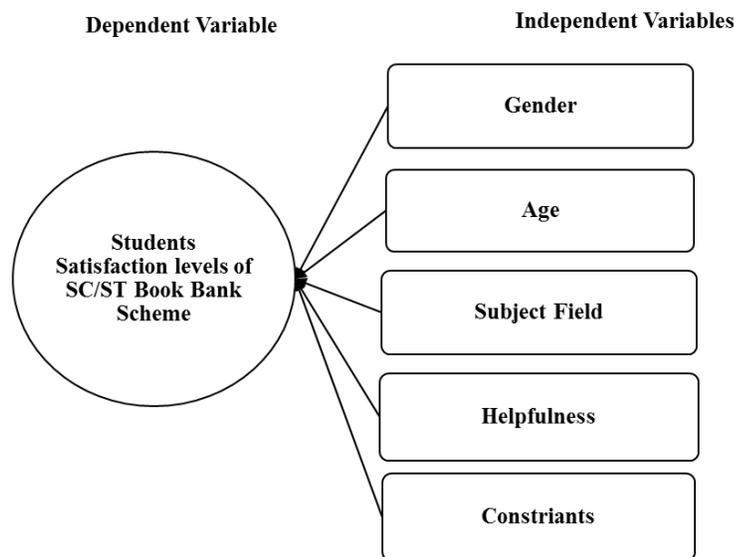


Figure 1: The model for engineering and life science students' perception towards the satisfaction of SC/ST Book Bank facility

Previous Studies

- **User satisfaction on SC/ST Book Bank Service in Library**

N Sharma (2019) endeavored to obtain information about the Book Bank administrations of selected college libraries in Assam, India. The investigation shrouded sixteen college libraries in three regions of Assam, India. Information is gathered through an organized survey, talk with strategy, and individual visits of the selected libraries. The investigation discoveries uncovered that larger part of college libraries have Book Bank Service, yet were not efficient. The libraries needed consistency in association and the management of book bank services. In another study, certifying the present status of the library of Sonubhau Balwant College assortment advancement, Waghmode, S. S (2013) communicated about Library administrations to outside peruses, Internet Facility, Book Bank Facility and Information about Competitive Exams. The author demanded that the library has been taking an interest in Book Bank Scheme for Backward Class understudies run by University of Mumbai, Mumbai from 1987-88 and included that assets were acquired from University of Mumbai and according to rules of the college, library had bought textbooks and reference books and gave to Scheduled caste students each year. Sachin and Garate (2017), during their examinations on use and fulfillment about the Book Bank Facility through its users, referenced that "Book Bank Facility' is one of the requested administrations in scholastic libraries". Information for the investigation was gathered from the understudies applied for the facility in the year 2014-15 through an organized survey. The examination of the data demonstrated that a larger part of users was exultant with the organization of the administration. The paper suggested that the book –bank facility must be rendered along with the commencement of course, and should include books for both the semesters i.e. including the complete syllabus for the year, to employ more library staff to render the service on time, and to make a subject-wise exhaustive list of books that library could provide under the Book Bank Scheme. Goyal and Joshi (1981) explained the concept of a Book - Bank as an operative at the Haryana Agriculture University including its year-wise growth in collection, rental charges received, and the use of books from 1975 to 1981. The author suggested some improvements to the scheme. An assessment of use of the book bank revealed there were many books that had no demand by book bank users. However, there was a good demand for the same titles in the main library. The decision was taken under the order of the Vice-Chancellor to transfer these books to the main library. Further, it was decided to purchase, only those titles that needed by the students. The study suggested that rental charges should not

be accepted from students belonging to backward classes. The amount received as rental charges should be utilized in the purchase of multiple copies of textbooks for book banks.

➤ **User satisfaction on Library services through ordinal regression**

Regression techniques are valued tools to study the association between several predictor variables and user satisfaction. The regression strategies are successful in enabling investigators to ascertain descriptive variables related to educational amenities that contribute to the overall satisfaction. These procedures, in addition, permit researchers to estimate the extent of the predictor variables impact on the dependent variable. Hence, regression techniques perform better in studying the connection between the dependent and independent variables (Thomas and Galambos (2002).

Godfred (2004) surveyed the contentment accomplished by using understudies in the different divisions of Polytechnic organizations in Ghana. The end result variable for understudy success with scholastic assist administrations used to be estimated on an arranged, absolute, and four-point Likert scale- 'very dissatisfied' through 'very satisfied'. Demographic variables included gender and departments, and forty-two questionnaire items related to the institutional services at the polytechnic. Cronbach's alpha indicated 0.90 and 0.94 for the satisfaction and importance questionnaire respectively. The discoveries uncovered that there was once certain input from respondents related to the nature of instructing in the Polytechnics with huge stages of success communicated for all territories of the exploration. Ababio et al (2012) aimed to determine the satisfaction level of college students regarding the accessible reading materials and the services supplied in the faculty library. The survey data obtained from college students of Kumasi Polytechnic library printed the typical satisfaction using ordinal logistic regression. Among the population, 57%, 30.8%, 6.7%, and 4.3% of them believed that the average service quality was once good, moderate, excellent, and negative respectively. On the whole, the estimated model recommended that among all the variables, availability of pioneering and applicable materials; enough user instructions; reliable net services as well as pleasant and beneficial library workforce had been the top library provider segments that especially influenced the student's rankings for overall carrier quality. Diverse arithmetical techniques employed to examine pleasure information including descriptive statistics, chi-square, linear regression analysis, multilevel modeling, and ordinal regression strategies (Cooney 2000, Baily et al 1998). Even though the number of studies involved in determining users' satisfaction on library services, the

present study is the first of its kind investigating users' level of satisfaction with the SC/ST book bank facility of life science and engineering college students building an ordinal regression model. This study will be useful for library professionals, academicians, and those who are interested in social welfare, to render efficient library services for the scheduled caste and tribe students.

Objectives

The purpose of the study was to identify satisfaction level of book bank scheme in libraries, using ordinal regression analysis, and inferring the study results. The user satisfaction survey was once examined through the ordinal regression model to accomplish the 4 investigation targets:

- To discover sizable unbiased variables that influenced the students' satisfaction level on the advantages and constraints of SC/ST book bank scheme;
- To estimate thresholds and regression estimates;
- To recognize the direction of the relationship between the independent variables and the users' discernment predominantly based on the advantageous and negative regression estimates; and
- To determine groupings for every satisfaction level of the participants and for this reason estimate the precision of the results.

Methodology

Keeping in view of the objectives, a survey method was adopted and prepared structured questionnaire considering undergraduates doing Engineering and Life science (Medicine, Veterinary and Dental) courses at Y.S.R. Kadapa district of Andhra Pradesh, and randomly distributed to 20 special category students of various discipline (8 colleges) constituting 160 questionnaires, among which 114 (71.25%) valid responses received as shown in Table 1. All libraries included in the study provide book bank services to economically backward students. The instrument for statistics collection consisted of structured (open/closed-ended) questions. The questionnaire was once administered to a sample of students to acquire statistics on their perceptions on the satisfaction of Book -Bank service at their respective libraries. A structured questionnaire was used in the study to gather data. The questionnaire had three parts: (1) Personal data of participants: containing gender, age, subject field, and Institution. 2) Users' perception of helpfulness of SC/ST book bank scheme in their academic carrier. Factor-I

“helpfulness” included 6 items viz. (q1) Favorable Library infrastructure (q2) Essential textbooks are supplied, (q3) Expert committee prescribes relevant textbooks, (q4) Books can be exchanged at any time during the semester, (q5) Students can avail any books according to their specific needs, (q6) No overdue charges, and (q7) Long term lending facility, (q8) Can be enrolled in the scheme free of cost. A 5-point Likert scale was employed to measure users’ perception of the SC/ST book- bank attributes in their library, ranging from 1 (completely dissatisfied) to 5 (completely satisfied). 3) Respondents’ opinion on constraints encountered in availing SC/ST book bank facility through a 5 point Likert scale. Factor-II “Constraints” included 11 items (q9) Lack of knowledge of where and how to obtain required materials, (q10) Finding difficulty while filling application form, (q11) Books are not circulated in time, (q12) Books do not cover the syllabus, (q13) Facing issues with getting enrolled in the scheme, (q14) Low standard books are supplied, (q15) Lack of availability of preferred books, (q16) Not given preference in recommending books, (q17) Hardly conducive state of the library services, (q18) Books are not distributed for the entire course (all semesters), (q19) Non-cooperative attitude of the library staff, 4) Overall satisfaction level of respondents, ranging from completely dissatisfied -1 through completely satisfied-5.

Table 1: Sample Size and response rate

S.No	Colleges	Location	Distributed	Received
Life Science (N=47)				
1	RIMS Medical College	Kadapa	20	14
2	RIMS Dental College	Kadapa	20	13
3	Govt. Homeopathy Medical College	Kadapa	20	02
4	College of Veterinary Science	Proddatur	20	18
Engineering (N=67)				
5	APIIT.R.K.Valley	Idupulapaya	20	15
6	Annamacharya College of Engineering	Rajampet	20	17
7	JNTUA College of Engineering	Pulivendula	20	16
8	Y.S.R. College of Engineering	Proddatur	20	19
	Total		160	114

71.25% (114) Response Rate

Ordinal Logistic Regression Model

The SPSS Ordinal Regression procedure, or PLUM (Polychromous Universal Model), is an extension of the general linear model to ordinal categorical data (Brant 1990). The important model essential Multiple Regression Analysis (MRA) locations that a steady result variable is, in value, a straight blend of variables and inaccuracies. The simple difference between ordinal

regression and multinomial regression is due to the fact of the proportionality of chances presumption. As indicated by way of this hypothesis, the influences of impartial elements are steady between varieties of stages of the consequence variable (McCullagh 1980). As such, the regression coefficients of predictor variables do not fluctuate between numbers of ranges of the dependent variable. The likelihood estimations of number levels of the outcome variable for a given set of explanatory variables differ simply because of the dissimilarities between intercepts for every degree of the dependent variable. In this manner, ordinal calculated regression conditions have the associated regular structure: (Breslaw & McIntosh, 1998)

- Y- Structured variable is an unnoticed, hidden (reorderable) ordered and grouped express variant. Conversely, it is uncertain whether the ordinal variable categories are divided by equal intervals.
- Ordinal regression evaluation uses the hyperlink feature to enlighten the results on the explanatory ordinal express variable, without the normality and homogeneity assumption of variances.
- The ordinal logistic regression model assumes that the relationship between the predictor variable and the ordered categorical variable is positively independent when you consider that the regression coefficient is no longer related to it.

In this study, an ordinal regression model was used to analyze the relationship between the outcome variable (i.e., different levels of satisfaction) and explanatory variables. Ordinal logistic regression equations have the following common form:

$$\ln \frac{(P(Y \leq i | x_1, x_2, \dots, x_p))}{(P(Y > i + 1 | x_1, x_2, \dots, x_p))} = \alpha_i - \beta_1 x_1 - \beta_2 x_2 - \dots - \beta_p x_p$$

Where, $i = 1, 2, 3 \dots k - 1$ relate to ordered levels of outcome variable that has a total number of k levels;

α_i refers to the intercept term for the i^{th} level of the dependent variable;

x_1, x_2, \dots, x_p match up to the predictor variables;

$\beta_1, \beta_2 \dots \beta_p$ indicates the regression coefficients for the corresponding explanatory variables.

Cumulative likelihoods related to each level of the satisfaction may be established by using equation:

$$P(Y \leq i | x_1, x_2, \dots, x_p) = \frac{\exp(\alpha_i - \beta_1 x_1 - \beta_2 x_2 - \dots - \beta_p x_p)}{[1 + \exp(\alpha_i - \beta_1 x_1 - \beta_2 x_2 - \dots - \beta_k x_p)]}$$

$$= \frac{1}{\{\exp[-(\alpha_i - \beta_1 x_1 - \beta_2 x_2 - \dots - \beta_p x_p)] + 1\}}$$

In order to seek out the likelihood associated to a particular degree of the variable, cumulative chance of the adjacent dependent level is subtracted from the cumulative probability of the extent of interest.

$$P(Y = i | x_1, \dots, x_p) = P(Y \leq i | x_1, \dots, x_p) - P(Y \leq (i - 1) | x_1, \dots, x_p)$$

Since the variations between regression equations of a number of degrees of the variable solely depend upon the intercept values for a given set of independent variables, the resultant regression equations are parallel lines for different levels of the variable (Bender and Benner 2000). The proportionality of odds assumption is frequently checked in SPSS by using the “Test of Parallel Lines” option. This test compares the -2 Log Likelihood value for a model at some point in which the regression coefficients are allowed to vary, with the -2 Log Likelihood value of the model that satisfies the proportional odds assumption (Winship and Mare 1984). A Chi-Square test is utilized to the likelihood ratios and if the result's large then the null hypothesis which states that the regression coefficients don't vary depending on the degree of the variable is rejected. Therefore, in order to use ordinal regression, the test of parallel lines ought to provide a non-significant result. Outcomes of the test of parallel lines depend on the independent variables present within the model (Madanat et al 1995). The high internal consistency for the survey instrument should be established to support the Cronbach's Alpha reliability, all items combined 0.887 (19 items), Factor-I 0.782 (8 items), and Factor-II 0.882 (11 items). This end result indicates that the survey is often used with about 88% confidence.

One of the statistical assessments of the applying of the model to be created is the statistic which indicates whether or not the model represents the statistics well. The null and alternative hypotheses testing the final validity of the model:

H0: The model represents the information well.

H1: Doesn't represent model information well.

In order for the model to be valid, the null assumption needs to be acquainted (Cohen J 1994).

Working research hypotheses are determined as:

H.1. There is no significant relationship between users' satisfaction and their gender.

H.2. There is no significant relationship between students' satisfaction and their age.

H.3. There is a meaningful relationship between user satisfaction and educational status.

Another approach is to use different link functions that establish the link between independent variables and also the ordinal variable. SPSS package (version 19) employed in this evaluation to figure out on a link function, it is useful to look at the distribution of values for the end result variable. A histogram (figure 2) generated for the dependent variables (here, user-level of satisfaction) to point out the distribution of categories of respondents' attitudes towards SC/ST book bank facility.

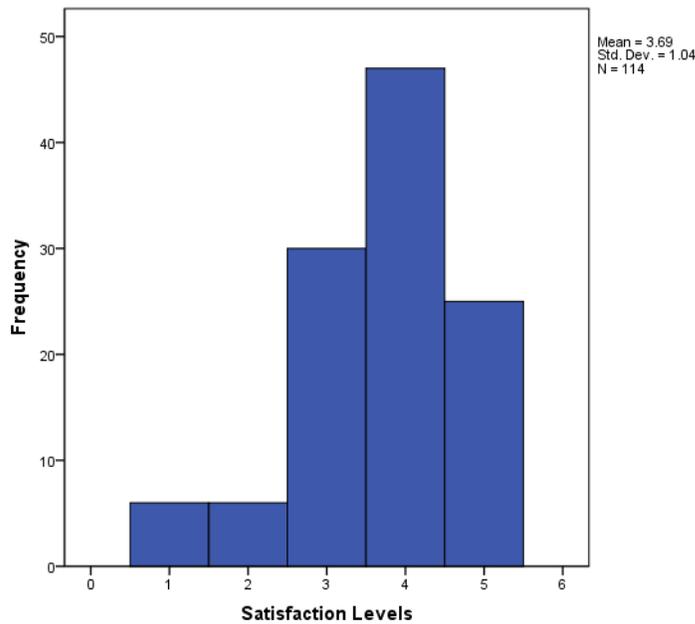


Figure 2: Distribution of SC/ST Book Bank Responses towards Satisfaction Levels

Ordinal logistic regression could be a specific case of generalized linear models during which logit function is employed to determine the connection between independent variables and consequently the ordinal variable extent (Norusis 2008). In cases where the logit function presents a negative suit for the information, specific link functions is additionally used. As seen in figure 1, the bulk of cases are skewed towards higher variables. For this reason, it was begun with the complement log-log link function,

$\ln(-\ln(1 - y)) = \alpha_i - \beta_1 X_1 - \beta_2 X_2 - \dots - \beta_p X_p$ Since that function focuses on the distribution at higher outcomes (Decarlo 2003).

Study Results

Ordinal Logistic Regression (OLR) is generally used when the data set contain categories for the dependent variable that are ordered (i.e. are ranked). Unlike Multinomial Logistic

Regression (MLR), which generate multiple regression co-efficient, OLR yields only a single set of regression co-efficients to estimate relationships between independent and dependent variables (McCullagh and Nelder 1989). As such, OLR provide a more parsimonious representations of the data than MLR when the dependent variable is ordered (Porter et al 1981). In this study, the researcher is studying the predictors of student's perceptions towards satisfaction on SC/ST Book Bank facilities in their respective libraries. Data collected from 114 students from Engineering and Life Science discipline on several variables.

- Subject is a binary variable: Code-1 indicate Engineering; Code-2 indicate Life Science.
- Again, Gender is a binary variable: Code-1 indicate Male; Code-2 indicate Female.
- Age is also a binary variable: Code-1 indicate 20-30 years; Code-2 indicate 31-40 years.
- Satisfactory level of students is an ordered categorical variable indicating their opinion on SC/ST book bank scheme. It is coded as follows: Code-1: Completely Dissatisfied; Code-2: Somewhat Dissatisfied; Code-3: Neutral; Code-4: Somewhat Satisfied; Code-5: Completely Satisfied.
- Helpfulness treated as continuous variable higher score indicate positive attitude of respondents.
- Constraints, again treated as a continuous variable, higher score indicates dissatisfaction among the respondents.

Here satisfactory level of students is the dependent variable, and remaining variable (Subject/Gender/Age) treated as factors, helpfulness and constraints having categorical variables at five levels (completely dissatisfied-1, to completely satisfied-5) treated as covariates. The data tested for goodness of fit statistics, summary statistics, parameter estimates and test of parallel lines using SPSS 19.0 Version (2010). The modeling is conducted with the aid of the complementary log- log link function. The case processing summary (Table 1) indicates the proportion of cases falling at each level of the dependent variable (Satisfaction Level).

Table 1: Case Processing Summary

Case Summary		N	Marginal (%)
Satisfaction Levels	Completely Dissatisfied	6	5.3
	Somewhat Dissatisfied	6	5.3
	Neutral	30	26.3
	Somewhat Satisfied	47	41.2
	Completely Satisfied	25	21.9

Gender	Male	60	52.6
	Female	54	47.4
Age	20-30	109	95.6
	31-40	5	4.4
Subject Field	Engineering	67	58.8
	Life Science	47	41.2
Total		114	100.0

(Figures in Parentheses indicate percentage)

Table 2: Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	273.146	69.321	22	.000
Final	203.825			

Link function: Complementary Log-log.

The Model fitting data (Table 2) contained the 2-Log probability for an intercept only model and therefore the full model (containing the complete set of predictors). We even have a probability ratio chi-square test to test whether there's a major enhancement within the fit of the final model relative to the intercept only model. During this case, we see an essential improvement within the suit of the final model over the intercept only model ($\chi^2(22) = 69.321, P < 0$).

Table 3: Goodness-of-Fit

Goodness-of-Fit	Chi-Square	Df	Sig.
Pearson	261.694	270	.630
Deviance	197.818	270	1.000

Link function: Complementary Log-log.

The goodness of fit (Table 3) contains the Deviance and Pearson Chi-Square tests, which are useful for determining whether a model exhibits decent appropriate the information (Andrew et al. 2014). During this analysis, we see that both the Pearson Chi-Square test ($\chi^2(270) = 0.630, P = 0.630 > 0.05$) and therefore the deviance test ($\chi^2(270) = 1.000, P = 1.000 > 0.05$) were both non-significant. Since non-significant test results are the indications that the model fits the information well (Vakhitova 2018), these results suggest a decent model fit.

Table 4: Pseudo-R-Square

Cox and Snell	.456
Nagelkerke	.488

McFadden	.224
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Link function: Complementary Log-log.

The pseudo-R-squares had been accustomed to examine the goodness of fit of our models. These measures attempt and serve the same function due to the fact the coefficient of determination in linear regression models specifically to summarize the proportion of odds inside the variable quantity related to the predictor variables. For ordinal regression models, these measures are supported via probability ratios as an alternative of raw residuals. Three distinctive techniques are accustomed to estimate the coefficient of determination. Cox and Snell's R -square (1989) could be an accepted generalization of the well-known measure designed to use when maximum likelihood estimation is employed, like ordinal regression. However, with categorical outcomes, it's a theoretical maximum value of 1.0. For this reason, Nagelkerke (1991) proposed a modification that allows the index to require values within a zero-to-one range. McFadden's R -square (1973) is another version, supported the log-likelihood scores for the intercept-only model and the full estimated model. What constitutes a "good" R2 value depends upon the character of the result and also the explanatory variables. Here, the pseudo R2 values (e.g. Nagelkerke = 49%) indicates that students' overall satisfaction on SC/ST book bank facility explains a comparatively small proportion of the variation among participants' pleasing level. this can be even as we might expect because there are numerous student, knowledge domain and management characteristics that impact on student attainment, many of which is able to be rather more important predictors of attainment than any simple association with satisfaction. Although the pseudo R- squares values are decent (Table 4), their strikingly low values point out that the constructs of benefits and constraints cannot alone supply adequate predictions of students' satisfaction. It will possibly be certainly worth the effort to revise the model consisting of greater predicting variables to enhance student satisfaction predictions. The next step appears at the predictions generated through the model. However, what we are probably most inquisitive about is how often the model can produce accurately predicted categories supporting the values of the predictor variables. We construct a classification table additionally known as a confusion matrix- by cross-tabulating the predicted classes with the unique categories. From Table 5 the model seems to be doing suitable of predicting outcome categories, for variables-category 1 (completely dissatisfied) the model classifies 5.3%, category two (somewhat dissatisfied)

classifies 5.3%, the category 3 (neutral) classifies 26.3%, the category 4 (somewhat satisfied) classifies 41.2% and additionally the category 5 (completely satisfied) classifies 21.9%.

Table 5: Predicted Response Category Cross tabulation

Satisfaction Levels	Predicted Response Category					Total
	Completely Dissatisfied	Somewhat Dissatisfied	Neutral	Somewhat Satisfied	Completely Satisfied	
Completely Dissatisfied	0	0	6 (5.3)	0	0	6 (5.3)
Somewhat Dissatisfied	1 (0.9)	0	1 (0.9)	4 (3.5)	0	6 (5.3)
Neutral	1 (0.9)	0	12 (10.5)	13 (11.4)	4 (3.5)	30 (26.3)
Somewhat Satisfied	0	1 (0.9)	3 (2.6)	36 (31.6)	7 (6.1)	47 (41.2)
Completely Satisfied	0	0	0	13 (11.4)	12 (10.5)	25 (21.9)
Total	2 (1.8)	1 (0.9)	22 (19.3)	66 (57.9)	23 (20.2)	114 (100.0)

(Figures in Parentheses indicate percentage)

H0: Model represents the information well.

H1: Doesn't represent model data well.

Ordinal Logistic Regression assumes that the connection between the independent variables is that the same across all possible comparisons (Menard 2000). Involving the variable quantity an assumption noted as proportional odds. The row labeled Null Hypothesis contains -2 log-likelihood (203.825) for the constrained model, the model that assumes the lines are parallel. The row labeled General is for the model with separate lines (201.836). The entry labeled Chi-Square (1.989) is that the difference between the $2 -2$ log-likelihood values. When the results of parallel lines i.e., assumption of proportional odds indicate non-significance, then we interpret it to mean that the belief is satisfied. Statistical signification is taken as an indicator that the belief isn't satisfied. The parallel lines are non-significant during a well-fitting model which meets the parallel line assumptions (Alexopoulos, 2010) within the results from our analysis, we interpret the results to mean that the belief is satisfied as $p = 1.00$ (Table 6). Hence, the null hypothesis is accepted.

Table 6: Test of Parallel Lines (proportional odds)

Model	-2 Log Likelihood	Chi-Square	Df	Sig.
Null Hypothesis	203.825	1.989 ^b	66	1.000
General	201.836 ^a			

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.

- a. The log-likelihood value cannot be further increased after maximum number of step-halving.
- b. The Chi-Square statistic is computed based on the log-likelihood value of the last iteration of the general model. Validity of the test is uncertain.
- c. Link function: Complementary Log-log.

Table 7: Parameter Estimates

Parameters	Estimate	Std. Error	Wald	Df	Sig.	95% Confidence Interval		Exponent B	
						Lower Bound	Upper Bound		
Threshold	Completely Dissatisfied	-2.411	1.821	1.753	1	.185	-5.980	1.158	0.08972552
	Somewhat Dissatisfied	-1.636	1.795	.831	1	.362	-5.155	1.883	0.1947575
	Neutral	.136	1.772	.006	1	.939	-3.336	3.609	1.145682
	Somewhat Satisfied	1.776	1.775	1.001	1	.317	-1.704	5.256	5.906184
Location	Gender-Male	-.805	.287	7.875	1	.005	-1.367	-.243	0.4470879
	Age-20-30	-1.466	.850	2.974	1	.085	-3.132	.200	0.230847
	Subject Field-Engineering	1.256	.440	8.131	1	.004	.393	2.119	3.511348
	Factor-1-q1Helpfulness	.342	.567	.364	1	.546	-.769	1.452	1.40776
	q2	.078	.398	.038	1	.845	-.702	.858	1.081123
	q3	-.497	1.274	.152	1	.696	-2.993	1.999	0.608353
	q4	-2.824	1.829	2.383	1	.123	-6.409	.762	0.059368
	q5	.875	.324	7.318	1	.007	.241	1.509	2.398875
	q6	-.739	.647	1.306	1	.253	-2.007	.529	0.4775913
	q7	-.430	.788	.298	1	.585	-1.974	1.113	0.6505091
	q8	3.965	1.574	6.347	1	.012	.880	7.049	52.72027
	Factor-2-q9Constraints	.007	.429	.000	1	.987	-.834	.848	1.007025
	q10	-1.546	.409	14.259	1	.000	-2.348	-.743	0.2130987
	q11	.312	.443	.495	1	.482	-.557	1.181	1.366155
	q12	.422	.834	.256	1	.613	-1.212	2.057	1.525009
	q13	-1.300	.643	4.092	1	.043	-2.560	-.040	0.2725318
	q14	1.982	.647	9.368	1	.002	.713	3.251	7.257243
	q15	.247	.555	.198	1	.656	-.841	1.335	1.280179
q16	-.951	.590	2.593	1	.107	-2.108	.206	0.3863545	
q17	.758	.466	2.647	1	.104	-.155	1.670	2.134004	
q18	.657	.390	2.837	1	.092	-.107	1.421	1.928997	

q19		-0.418	0.758	0.304	1	0.582	-1.904	1.068	0.6583622
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Link function: Complementary Log-log.

a. This parameter is set to zero because it is redundant.

We have got the regression coefficients and significance test for every of the predictor variables within the model. The regression coefficients are certainly interpreted because of the predicted change in log odds of being throughout a higher (as opposition a lower) category on the variable (controlling for the remaining experimental variables) per unit increase on the independent variable (Ranganathan, P et al, 2017). As such, we interpret positive coefficients in the following way: for every one-unit increase on an independent variable, there is a predicated increase (of a certain amount) in the log odds of following a higher level of the dependent variable. More generally, this indicates a score increase on the independent variable, there is an increased probability of falling at a higher level on the dependent variable (Schneider et al., 2010). We interpret a negative estimate within the following way: for each one-unit increase on a variable, there's a predicted decrease (of a certain amount) within the log odds of falling at a higher level of the variable. More generally, this means that as values increases on an experimental variable, there's a decreased probability of falling at a better level on the variable (Peduzzi et al, 1996).

An Ordinal Logistic Regression (OLR) test results related to the experimental variable are based solely on the Wald test. Their results may be less powerful than test results supported the employment of the likelihood ratio chi-square test. Using “R” programing language models we obtain additional information (R core team 2014). The exponent (B) column contains odds ratio’s reflecting the multiplicative change within the odds of being during a higher category on the variable for each one-unit increase on the independent variables, holding the remaining independent variables constant. An odds ratio greater than 1 suggests an increased probability of being during a higher level on the variable as values on the experimental variable increase, whereas a ratio but 1 suggests a decreasing probability with increasing values on the experimental variable. An odds ratio capable 1, suggest no predicted change within the likelihood of being during a higher category as values on an experimental variable increase. The thresholds are shown at the highest of the parameter estimates output, and that they indicate where the latent variable is move make the factors that we observe in our data.

H.1. There is no significant relationship between users’ satisfaction and their gender.

“Gender”, identification was not a significant predictor (because this is a binary variable the slope can be thought as of the difference in log-odds between groups. On average the log odds of the male being in a lower satisfaction were 0.48 points higher on average for compared to female.

H.2. There is no significant relationship between students’ satisfaction and their age.

“Age” was not a significant positive predictor of satisfaction. Since age is a binary variable, the slope represents the difference in log-odds between individuals in the age group “20-30” and “31-40. The log odds of being in a lower satisfactory level was 0.23 points higher on average for those who were between the age group 31-40.

H.3. There is a meaningful relationship between user satisfaction and academic status.

Subject” was a big predictor within the model. The coefficient is interpreted as follows: for each one-unit increase within the engineering students, there's a predicted increase of 3.5 points within the log odds of being in a very higher level of satisfaction compared to life science students. Significant positive predictors of the log odds of engineering students being higher (or lower as opposed to life science student) category of satisfaction. For Factor-I “Helpfulness” (included 8 items), we find q1-Favorable Library infrastructure (1.41), q2- Essential textbooks are supplied (1.08), (q5) Students can avail any books according to their specific needs (2.39), q8-Can be enrolled in the scheme free of cost (52.72) is significant. While q3-Expert committee prescribes relevant textbooks (0.61), q4-Books can be exchanged at any time during the semester (0.06), q6-No over-due charges (0.48), and q7-Long term lending facility (0.65) are not significant. For Factor-II “Constraints” (included 11 items), we find q11- Books are not circulated in time (1.37), q12- Books do not cover syllabus (1.53), q14-Low standard books are supplied (7.26), q15-Lack of availability of preferred books (1.28), q17- Not given preference in recommending books (2.14), q18- Books are not distributed for the entire course (all semesters) (1.93) are significant obstacles encountered by special category students in availing book bank facility. On the other hand, q10-Finding difficulty while filling application form (0.21), q13-Facing issues with getting enrolled in the scheme (0.27), q16- Hardly conducive state of the library services (0.39), q19- Non-cooperative attitude of the library staff (0.66) is found to be not a significant barrier; further q9-Lack of knowledge of where and how to obtain required materials (1.00) indicates no predicted change in the likelihood of satisfaction.

Suggestions for future improvement

- Textbooks should be distributed along with the commencement of the courses.
- SC/ST Book bank facility should include books for all the semesters i.e. including a complete syllabus for the year.
- Organizations should ensure books are circulated on time.
- Students' preferences should also be considered in addition to the faculty's suggestion while selecting books.
- Feedback on the book bank scheme should be collected from students at regular intervals.

Conclusion

In this study, the ordinal regression analysis was implemented to explore and examine the connection among the special category students belonging to Life science (41.2%) and Engineering (59%) discipline, at Y.S.R Kadapa district of Andhra Pradesh and sought their perception towards SC/ST book bank facility available in their respective libraries. Most participants (95.6%) belonged to the age group 20-30 years and merely 4.4% were between the ages of 31-40 years. 52.6% of males and 47.4 % of the female population participated in the survey. "Gender" and "Age" were not a significant predictor of satisfaction. "Subject" was a significant predictor of the model. The findings revealed respondents were somewhat satisfied (41.2%) with the SC/ST book bank scheme, however, 22% of respondents showed complete satisfaction towards the book bank service. Respondents showed a positive attitude on book bank features such as favorable library infra-structure, the supply of essential textbooks, and facilities to avail textbooks according to their needs. On the other hand, lack of circulation of books on time and issues with a circulation of books for the entire course were found to be significant negative predictors. The study suggested that management and libraries should play a prominent role in providing facilities and services to special category students and considering students' preference for book selection is valued.

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