



Competencies and teaching effectiveness in social sciences at Indian agricultural universities

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ABSTRACT

In India, teaching, research and extension are the three pillars of National Agricultural Research and Education System (NARES) in which agricultural extension connects agricultural research and farmers. Teaching in agricultural extension discipline across agricultural universities at postgraduate level prepares extension professionals to conduct need based research and transfer relevant technologies to farming community. The present study primarily focuses on assessing the overall teaching effectiveness of agricultural universities with respect to extension education discipline in order to understand the competence level of extension graduates from Indian agricultural universities. The investigation is based on primary data compiled from 66 teachers engaged in teaching of extension education discipline and 210 postgraduate (M Sc and Ph D) students across 10 agricultural universities of Northern India. It was found that majority of the students (64.29%) perceived that overall acquisition of essential extension competencies is low, while only 10.94 percent of students perceived it to be high. Out of the 10 universities examined for teaching effectiveness, six had medium teaching effectiveness, while two universities had high and two universities had low teaching effectiveness. The overall teaching effectiveness index of all 10 universities was 0.607 indicating a teaching effectiveness of above average. The present study therefore identified those essential extension competencies which need emphasis in the extension education teaching-learning scenario. The teaching effectiveness index developed can be used by agricultural universities to assess teaching effectiveness of extension education teachers.

Key words: Agricultural universities, Extension competencies, Extension education, Postgraduate students, Teaching effectiveness

Agricultural extension requires a role renewal to move beyond the traditional boundaries of technology transfer to contemporary concerns of knowledge management, marketing strategies, information dissemination, and stakeholder networking (Glendenning *et al.* 2010; Kokate *et al.* 2016). However, this paradigm shift in agricultural extension practice can be made feasible through simultaneous development in agricultural extension education system within agricultural universities (Sulaiman and van den Ban 2000; Kokate *et al.* 2016). In India, public sector is major Extension service providers through a two-tier system. At the central level, Indian Council of Agriculture Research (ICAR)

is the nodal institute for agriculture research and extension; while at the state level, the State Agricultural Universities (SAU) via the Krishi Vigyan Kendra (KVKs) and Agriculture Technology Management Agency (ATMA) at the district level facilitate agriculture extension (Nandi and Nedumaran 2019). Extension researches and teaching are being practised by teachers and students in more than 70 Agricultural Universities but the linkage between extension education and extension practices is uncoordinated and ineffective (Ferroni and Zhou 2012). Further, studies have suggested that agricultural universities were unable to produce the desired level of competence among students pursuing higher education in agricultural extension due to inappropriate curriculum and pedagogical approaches (Sulaiman and van den Ban 2000). The Fifth Deans' Committee Report of Agricultural Education Division, Indian Council of Agricultural Research (2017) also noted the constraints in teaching effectiveness with special reference to Social Sciences among agricultural universities and concluded that overall teaching effectiveness is not adequate as there is a disconnect between agricultural education, employment, and industry requirements and lack of essential skill, entrepreneurial orientation and experiential learning.

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Agricultural extension educators must possess specific set of competencies in order to bring the paradigm shift and the same should be imbibed by the student community as well (Mulder 2016). Henceforth, the teaching effectiveness plays a critical role in transfer of competencies from teachers to students. Ensuring high teaching quality in agricultural education with special focus on extension, thus becomes an important concern in order to develop extension professionals with appropriate skills and attitude to take the fate of agriculture in the right direction and therefore in long run ensuring food security for all (FAO 2014). Moreover, agricultural extension practices which are largely determined by the status of agricultural education are also affected by its poor outcomes. Hence, a revamped agricultural extension education system is critical for the growth and success of farm enterprises (Ferroni and Zhou 2011). This study is an attempt to identify the extent of effectiveness of extension teaching-learning environment in agricultural universities along with acquired competencies by extension students in the Indian context.

MATERIALS AND METHODS

The present study was conducted in universities of Northern India comprising a total of 23 universities (having Agriculture as a subject of study) which are located in Jammu and Kashmir, Himachal Pradesh, Punjab, Uttarakhand, Uttar Pradesh, Haryana and New Delhi respectively. Ten universities out of 23 were selected randomly with all teachers and postgraduate students (M Sc and Ph D) of extension education discipline as the respondents. Thus, the final count of respondents included 66 teachers and 210 postgraduate students. To measure teaching effectiveness, an index was developed and validated as follows.

Step I: Collection and finalization of indicators and sub-indicators: An exhaustive list of teaching effectiveness indicators and sub-indicators was identified and finalized after extensive literature review and discussion with experts, teachers and students. The indicators of teaching effectiveness index selected were teacher related variables, student related variables and institute related variables. In total, 24 indicators were identified to measure teaching effectiveness (Table 3). Data on each indicator was collected through a structured questionnaire using tested and validated scales.

Step II: Developing sub-teaching effectiveness index: A sub-index was developed for each variable by normalizing the data using the following formula. The high index values reflected high teaching effectiveness and low index values reflected low teaching effectiveness.

Sub Index = $\frac{\text{Actual value} - \text{Minimum value}}{\text{Maximum value} - \text{Minimum value}}$

Step III: Assigning weights through PCA analysis: After standardizing the data, weights were attached to the indicators by using Principal Component Analysis (PCA) with the help of statistical software SAS version 9.3. PCA analysis also enabled us to consolidate the number of variables into few principal components.

Step IV: Computation of final teaching effectiveness index: The assigned weights were then multiplied with each variable to calculate each principal component score by taking their linear summation. The PCA score of those principal components were considered for final teaching effectiveness index which explained more than 95% of total variation. The summations of average index scores of those selected principal components were chosen for final teaching effectiveness index. After the final index was prepared, teaching effectiveness for all ten agricultural universities was calculated and then it was classified into three categories namely, high, medium and low on the basis of individual teaching effectiveness score. The classification was done using cumulative cube root frequency (CCRF) method. Finally, linear regression analysis was employed to test the validity of the teaching effectiveness index.

For measuring acquired competencies, 25 extension competencies which were found to be crucial for performing extension field work were identified on the basis of extensive review of literature and discussion with experts. These 25 extension competencies were further consolidated into five categories, viz. Extension/Extension Management, Communication/Development Communication, Training/Human Resources Management, Research Methodology and Sociology/Psychology. Each category had five competencies each. Student perception regarding acquisition of identified extension competencies (whether they can apply particular competency practically) was measured using a five point scale. Weighted mean score of each competency was calculated and overall weighted mean score of each category was compared to finally rank these five categories on the basis of perception of students. On the basis of mean and standard deviation, acquisition of competencies was categorized as high, medium and low.

RESULTS AND DISCUSSION

Perception of students regarding acquisition of extension competencies

Table 1 shows that students ranked 'Communication/Development Communication' category as first followed by 'Extension/Extension Management', 'Research Methodology' and 'Training/Human Resources Management' with second, third and fourth rank respectively. The 'Sociology/ Psychology' category was given the last rank. This indicates that students believed that they

Table 1 Overall ranking of extension competencies categories based on weighted mean score (WMS) (n=210)

Competency (Broad categories)	WMS	Rank
Extension/Extension Management	2.71	II
Communication/Development Communication	3.05	I
Training/Human Resources Management	1.61	IV
Research Methodology	2.52	III
Sociology/ Psychology	0.92	V

had appropriate acquisition of competencies related to 'Communication/Development Communication', whereas in context of 'Extension/Extension Management' and 'Research Methodology' competencies, certain improvement is required. The weighted mean score for competencies related to 'Training/Human Resources Management' and 'Sociology/Psychology' was less than two which clearly shows the lack or absence of acquisition.

The acquisition of extension competencies was divided into three categories on the basis of mean and standard deviation. It is evident from the Table 2 that majority of the students (64.29%) perceived that overall acquisition of extension competencies was low, followed by 24.77 percent of students who believed that overall acquisition of extension competencies belonged to medium category. Only 10.94% of students perceived that acquisition of extension competencies was high. Hence, it can be concluded that majority of the students perceived that acquisition of extension competencies was in the range of low to medium.

It is evident from Table 2 that out of 25 competencies, acquisition of fifteen competencies ('Planning and implementing development program', 'Training needs assessment', 'Qualitative research methods', 'Technology evaluation', 'Developing agricultural communication

projects', 'Preparation of HRD plans for extension organizations', 'Experiential learning methods', 'Entrepreneurship plan development', 'Constructing a scale', 'Data analysis in SPSS/SAS/R software', 'Identifying gender roles', 'Gender budgeting', 'Development of gender mainstreaming plan', 'Gender analysis' and 'Gender sensitivity training') were categorized under low category by students which clearly shows that universities were not able to inculcate these competencies among postgraduate students of extension education.

Table 2 also reveals that six competencies ('Production of different projected and non-projected media', 'Designing effective training programs', 'Participatory Extension methodologies', 'Research writing', 'PERT and CPM applications in projects' and 'Identification of opinion leaders') were categorized under medium category by students which clearly shows that universities were able to inculcate these competencies up to satisfactory level among postgraduate students of extension education but still these competencies can further be enhanced. Table 2 also shows that four competencies ('Management techniques', 'Designing power point presentation/video media', 'Creating News stories, magazine articles, farm bulletins and folders' and 'Quantitative research methods') were categorized under high category by students which shows that universities

Table 2 Distribution of students based on their perception with respect to acquisition of extension competencies at postgraduate level (n=210)

Category	Frequency	Percentage	Competency
Low (< 49.95)	135	64.29	Planning and implementing development program Training needs assessment Qualitative research methods Technology evaluation Developing agricultural communication projects Preparation of HRD plans for extension organizations Experiential learning methods Entrepreneurship plan development Constructing a scale Data analysis (SPSS/R software) Identifying gender roles Gender budgeting Development of gender mainstreaming plan Gender analysis Gender sensitivity training
Medium (49.95-58.33)	52	24.77	Production of different projected and non-projected media Designing effective training programs Participatory extension methodologies (PRA, RRA, PTD) Research writing (papers, reports, articles etc.) PERT and CPM applications in projects Identification of opinion leaders
High (> 58.33)	23	10.94	Management techniques (Delphi, TQM, Nominal group technique) Designing powerpoint presentation/video media Creating news stories, magazine articles, farm bulletins and folders Quantitative research methods
Total	210	100	-

[Max= 68, Min=38, Mean=54.14, S.D. = 4.19]

were able to adequately inculcate these competencies among postgraduate students of extension education.

The above findings were concordant with the findings of Sandhu (1981), Singh and Vijayaraghavan (1995), Sulaiman (1996) and Sulaiman and van den Ban (2000) who concluded that students of Agricultural Universities lack essential extension competencies in areas of extension management, development communication, human resources management and research methodology.

Teaching effectiveness measurement through teaching effectiveness index

The teaching effectiveness index was calculated based on the 24 variables. Principal Component Analysis (PCA) was employed to find out those principal components which explained majority of the variation of dependent variable (teaching effectiveness). From Table 3 it was evident that 97.56% of total variance was explained by first 14 principal components. So, PCA score of only first fourteen principal components was taken for calculation of final teaching effectiveness index.

Based on the PCA score of fourteen components, the mean teaching effectiveness score for each respondent was calculated. Then, overall mean teaching effectiveness

score of all universities was calculated which was 0.607 indicating a teaching effectiveness of above average. Also, mean teaching effectiveness score for each university was calculated which is shown in Table 4.

Overall respondents were categorized on the basis of their teaching effectiveness score (high, medium and low) through cumulative cube root frequency method which is a standardized tool to categorize the data for continuous variable. It is evident from Fig 1 that majority of teachers' and students' (51.01%) categorized teaching effectiveness as medium followed, while 26.34% perceived to be low and 22.65% as high, which clearly indicates that the teaching effectiveness ranged from low to medium level.

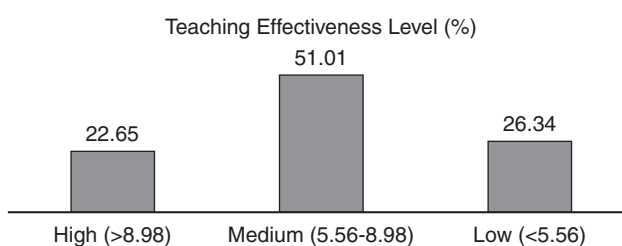


Fig 1 Distribution of the overall teaching effectiveness score (n=276)

Table 3 Eigen values and cumulative proportion of the principal components considered for calculating teaching effectiveness index

Variables (Sub indicators)	Eigen values	Difference	Proportion	Cumulative
Job Experience*	0.72341565	0.17654326	0.2112	0.2112
Job Commitment*	0.54687239	0.08543732	0.1106	0.3227
Achievement Motivation *	0.46143507	0.07652341	0.1088	0.4315
Self Confidence*	0.38491166	0.05756358	0.1012	0.5327
Professional Productivity*	0.32734808	0.03559812	0.1011	0.6338
Instructional Skills*	0.29174996	0.02138765	0.0976	0.7314
Immediacy *	0.27036231	0.01653782	0.0711	0.8023
Academic Performance **	0.25382449	0.01356725	0.0432	0.8455
Achievement Motivation**	0.24025724	0.00467136	0.0347	0.8802
Classroom Interaction*	0.23558588	0.00356137	0.0298	0.9100
HRD Activities***	0.23202451	0.00316652	0.0287	0.9387
Teaching Infrastructure***	0.22885799	0.00216784	0.0168	0.9555
Personal Attributes *	0.22669015	0.00167452	0.0102	0.9657
Self Confidence*	0.22501563	0.00252381	0.0099	0.9756
Educational Qualification *	0.22249182	0.00148736	0.0097	0.9853
Job Satisfaction *	0.22100446	0.00117655	0.0032	0.9885
Attitude Towards Profession *	0.21821929	0.00278517	0.0030	0.9915
Relationship with Students'*	0.21543412	0.00157335	0.0027	0.9942
Medium of School Education**	0.21316663	0.00226749	0.0021	0.9963
Strength of Teaching Staff***	0.21089914	0.02235882	0.0019	0.9982
Working Conditions and Facilities***	0.18854032	0.05215887	0.0010	0.9992
Promotion***	0.13638145	0.04743216	0.0003	0.9995
Feedback Mechanism***	0.08894929	0.07568924	0.0003	0.9998
Administrative Support***	0.01326005	-	0.0002	1.000

(*Teacher related variable, **Student related variable and ***Institute related variable)

Table 4 Over all teaching effectiveness index and individual teaching effectiveness index of Agricultural Universities (n=276)

Agricultural university	Number of respondents	Teaching effectiveness index	Over all teaching effectiveness index
Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand (GBPUAT)	40	0.69	0.607
Indian Agricultural Research Institute, New Delhi (IARI)	36	0.74	
Punjab Agricultural University, Ludhiana, Punjab (PAU)	34	0.64	
Indian Veterinary Research Institute, Bareilly, Uttar Pradesh (IVRI)	19	0.65	
National Dairy Research Institute, Karnal, Haryana (NDRI)	24	0.67	
Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana (HAU)	26	0.59	
Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu, Jammu and Kashmir (SKUAST)	20	0.56	
Chandra Shekhar Azad University of Agriculture and Technology (CSAUAT) Kanpur, Uttar Pradesh (CSAUAT)	21	0.46	
Sam Higginbottom University of Agriculture, Technology and Sciences, Naini, Prayagraj, Uttar Pradesh (SHUATS)	19	0.51	
Banaras Hindu University, Varanasi, Uttar Pradesh (BHU)	37	0.58	

Based on mean and standard deviation of teaching effectiveness index of all 10 universities, universities were categorized as high, medium and low. It is evident from Table 5 that out of 10 universities, majority of them (six universities) have medium teaching effectiveness. Two universities have high and two universities have low teaching effectiveness. These findings also support the ICAR ranking of agricultural universities (2016-17).

Most universities who were categorized under high and medium level of teaching effectiveness are in top ten ranks of ICAR ranking (2016-17). These universities include NDRI (Rank 1), IARI (Rank 2), PAU (Rank 3), HAU (Rank 4), IVRI (Rank 5) and GBPUAT (Rank 8). The two universities which were categorized under low category of teaching effectiveness had also low rank in ICAR ranking (2016-17). These universities include SHUATS (Rank 30) and CSAUAT (Rank 53). This clearly indicates that those universities which have high teaching effectiveness had also secured high ranks in national ranking of agricultural universities.

To test the validity of the regression model and to identify predictor variables for the dependent variable, i.e. teaching effectiveness index, multiple regression analysis was carried out with Enter Method. The R^2 value of 0.871 indicated that 87.10% of total variation in the dependent variable was explained by independent variables (Table 6). This shows that the regression model was valid and effective. The Durbin-Watson value of 1.732 indicated the independence of observations.

Table 6 Results of multiple regression analysis

R	R^2	Adjusted R^2	Standard Error of Estimate	Durbin-Watson
0.894	0.871	0.870	0.02745	1.732

Conclusion

The present study had assessed the extent of competencies acquired by postgraduate students of Extension Education pursuing their degree programmes in Indian agricultural universities and found lack of certain essential extension competencies. This lack often results in unemployment or poor employability as well as ineffective work performance in the field (XI Agricultural Science Congress Report 2013).

The present study also assessed the teaching effectiveness of extension teaching-learning system in agricultural universities and formulated a teaching effectiveness index. The findings were in line with Kumar *et al.* (2014) who also studied teaching effectiveness in Indian agricultural universities with special reference to agricultural extension and concluded that effectiveness of teaching depends on social, psychological and professional characteristics of teachers and students along with the teaching facilities provided by universities. Further, academic achievement and personality traits of faculty members of Indian agricultural universities and their effect on teaching and research performance was studied by Ramesh *et al.* (2016) who pointed out that there is an urgent need of diverse teaching pedagogy in social sciences at Agricultural Universities in order to inculcate desired

Table 5 Distribution of agricultural universities based on teaching effectiveness index (n=10)

Category	Agricultural University
Low (less than 0.525)	CSAUAT and SHUAST
Medium (0.525-0.688)	PAU, IVRI, NDRI, HAU, SKUAST and BHU
High (more than 0.688)	GBPUAT and IARI

[Max=0.74, Min=0.46, Mean=0.607, S.D= 0.0812]

competencies among students.

The present study had formulated and validated a teaching effectiveness index on the basis of 24 variables with respect to teachers, students and institution. This index clearly reflects the overall teaching effectiveness of all universities under study. The index can be further used by researchers to assess teaching effectiveness of their respective universities. Secondly the universities whose teaching effectiveness index was found under low category, they can reorient their teaching methodologies on the basis of twenty four variables under study. Furthermore, researchers can formulate framework for effective teaching on the basis socio-personal, psychological and professional characteristics of teachers' and students' and institutional variables contributing towards teaching effectiveness.

It is now crucial to reinvigorate the agricultural extension discipline across agricultural universities and reorient teaching-learning environment based on needs of farmers, industry and other relevant stakeholders (Ferroni and Zhou 2011). This is high time when Extension Education discipline at PG level should reorient its curriculum and teaching methodologies for achieving greater teaching effectiveness.

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