Differential Effect of Socio-Demographic Factors on Teaching Competence of Pre-Service Physical Science Teachers

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Abstract:

The present study aimed to investigate the differential effect of selected demographic factors on teaching competency of pre-service physical science teachers. The Professional Competency Scale for Secondary School Teachers, developed by the investigators, was administered along with a Demographic cum Socio-Economic Status Scale on a sample of 482 pre-service physical science teachers, selected on a stratified random basis, from three districts of Tamil Nadu. The data, thus collected, were subjected to statistical analysis (t-test and One-way ANOVA) by keeping the objectives and hypotheses in mind. The study revealed a differential effect of gender, residential locale, entry level educational qualification, and academic achievement on teaching competency of the participants. The socio-economic status of the family, however, is not decisive in discriminating pre-service physical science teachers on the basis of their teaching competency. The educational implications of the findings are further discussed.

Index Terms: Teaching competency, Socio-demographic factors, Pre-service physical science teachers.

1. INTRODUCTION

The role of teacher in the process of education is vital. The teacher is the yardstick that measures the achievement and aspiration of the nation. The quality of teachers is decisive in ensuring the quality of education in any society. One cannot expect quality education without having quality teacher, which in turn depends upon quality teacher education. The strength of an educational system largely depends upon the quality of teachers. A quality teacher is the major criterion for offering the quality education. Research has emphasized the importance of effective teachers as the most critical factor in determining school and student success (Roy & Halder, 2018; Kola, Sunday & Ayinde, 2015; Klein, 2014; Sadeghi & Nikou, 2012; Mathers & Olivia, 2008; Goldhaber & Anthony, 2007).

The quality of science education in India continues to be an area of big concern (Virk, 2017; Desiraju, 2008). Science teaching in our country is based strictly on the prescribed textbooks, which the students and teachers follow them slavishly. Over emphasis has been given to isolated factual information, rote memorization, and skill development is often limited to drawing selected diagrams and their labelling. No problem solving skills are developed in the learners, no creative thinking is promoted in the learners, interest in science, appreciation of science, attitude towards science and scientists, scientific values etc. are all totally neglected (British Council, 2019; Vivekananda International Foundation, 2019; Kumar & Singh, 2018). Science teachers in India consider their primary duty as clarifying the subject matter presented in the textbook to their pupils and enable them to memorize the text (Fuller & Clark, 2006). Quite often, in science classrooms, teachers emphasized the product aspects rather than process aspects of science (Raj & Kumar, 2015). A study conducted by Arjunan (2016) pointed out that Science Teachers are as superstitious as Social Science Teachers and they are not better than Language Teachers in their attitude towards science. A study conducted by Abhi (2013) in Kerala context arrived at a conclusion that teachers handling science subjects and those teaching languages in high school classes do not differ significantly with regard to their attitude towards science. hockingly this situation is not fully changed even after many recommendations made in at the national level, to improve science teaching in our schools (Garg, 2014).

Steps to improve the quality of science teaching in our schools should start right from teacher preparation. Teachers' quality is perhaps the most important factor that affect teaching of science in our schools. Apart from their attitudes, interests, values, temperament, mental abilities their social-cultural environment exert great influence on their professional competency as teachers. Though studies on the effect of teachers' personality factors on their professional competence is extravagantly available in literature, studies on socio-demographic factors affecting teaching competency of science teachers are scanty. In this context, this study aims to find out the effect of selected socio-demographic factors on the teaching competency of pre-service physical science teachers.

2. OBJECTIVE OF THE STUDY

The objective of the study is to find out the differential effect of gender, residential locale, entry qualification, socio-economic status and academic achievement on teaching competency of pre-service physical science teachers.

3. HYPOTHESES OF THE STUDY

The following null hypotheses were tested for the study:

$H_0 1$: There is no significant difference between male and female pre-service physical science teachers regarding their teaching competency.

$H_0 2$: There is no significant difference among pre-service physical science teachers from rural, semi-urban and urban areas regarding their teaching competency.

$H_0 3$: There is no significant difference between graduate and post-graduate pre-service physical science teachers in their teaching competency.

$H_0 4$: There is no significant difference among pre-service physical science teachers from high-, average-, and low socio-economic status with regard to their teaching competency.

$H_0 5$: There is no significant difference among high-, average-, and low achieving pre-service physical science teachers with regard to their teaching competency.

4. METHODOLOGY

4.1 Method

Descriptive research design that followed normative survey method was adopted for the study.

4.2 Population

The Pre-Service Teachers doing their second year B.Ed. Degree Course by taking Physical Science as their optional subjects in colleges affiliated to Tamil Nadu Teacher Education University, Chennai (Tamil Nadu, India), constitute the population for the study. An approximate estimate of the population of the present study is about seven thousand.

4.3 The Sample

A group of 482 pre-service physical science teachers (male = 136, and female = 346), selected on the basis of *'stratified random sampling technique'* from Kanyakumari, Thirunelveli and Coimbatore districts of Tamil Nadu (India) constituted the sample for the study.

4.4 Tools Used

a) *Professional Competency Scale for Secondary School Teachers (PCST):* The teaching competence of the pre-service physical science teachers was assessed by administering the PCST developed by the investigators. It is a 40 item, 5-point Likert-type scale which covers five domains of teaching competency viz., Planning, Instructional Presentation, Teaching Aides, Class Management, and Monitoring of Student Performance. The PCST has an external validity (supervisor rating as external criterion) of 0.76 and split-half reliability of 0.79.

b) *Demographic cum Socio-Economic Status Scale:* The socio-demographic data needed for the study was collected with the help of a personal data sheet with built-in socio-economic status scale, developed by investigators.

4.5 Procedure

The teaching competency of the participants were assessed during their teaching practice by their supervisory teacher in the practicing school and also the teacher educator of the trainees, and the average score was taken as the measure of their teaching competency. The demographic details as well socio-economic status of the participants were collected by administering the Demographic cum Socio-Economic Status Scale on the sample with the help of their teacher educators. The data thus obtained were subjected to appropriate statistical treatment with SPSS and interpreted accordingly.

5. ANALYSIS AND INTERPRETATION

The statistical analysis performed to test the hypotheses are given under suitable sub-headings:

5.1 Descriptive Statistics of PCST Scores

The major statistical indices such as Mean (M), Median (Mdn), Standard Deviation (σ), Skewness (Sk), Kurtosis (Ku), and Standard error of Mean (SE_M), calculated from the scores obtained on the Professional Competency Scale for Secondary School Teachers (PCST) for the total sample and sub-samples are presented in Table 1.

Table 1: Statistical Indices Pertained to Teaching Competency of Pre-service Physical Science Teachers

Groups	Sample	N	Range	M	Mdn	σ	Sk	Ku	SE$_M$
Whole	Total	482	76	124.53	122.5	17.77	0.331	-0.81	0.81
Gender	Male	136	73	133.95	137.0	19.73	-0.39	-0.88	1.69
	Female	346	73	120.82	118.0	15.47	0.49	-0.44	0.83
Qualification	UG	247	76	122.68	119.0	17.83	0.54	-0.58	1.13
	PG	235	73	126.46	126.0	17.55	0.13	-0.90	1.15
Locale	Rural	242	76	121.46	118.0	16.55	0.45	-0.55	1.06
	Semi-urban	103	70	125.13	124.0	17.70	0.42	-0.69	1.74
	Urban	137	74	129.49	131.0	18.84	-0.01	-1.06	1.61
SES	Low	83	73	123.0	121.0	18.73	0.30	-0.81	2.06
	Average	324	75	124.46	122.0	17.36	0.34	-0.81	0.97
	High	75	68	126.52	124.0	18.50	0.37	-0.84	2.14
ACH	Low	138	75	119.28	115.5	16.85	083	0.06	1.44
	Average	249	70	125.99	124.0	17.72	0.22	-0.93	1.12
	High	95	76	128.32	130.0	17.71	0.01	-0.69	1.82

The statistical indices pertained to the teaching competency of pre-service physical science teachers show that the group under study is heterogeneous with regard to their teaching competency. The range of the distribution estimated for the total sample is 76 with the highest score of 164 out of a maximum score of 200 and the lowest score obtained is 88 out of a minimum of 40. The Arithmetic Mean (M) estimated for the total sample is 124.53 with a Standard Deviation (σ) of 17.77; the Median (Mdn) values estimated is 122.5. The distribution is faintly platykurtic (ku = -0.81) and is skewed slightly to the high end (sk = 0.331) pushing the scores to the low end of the distribution. The estimated skewness, however, is negligible as the scores lie between +½ and -½. The Standard Error of Mean (SE$_M$) estimated for the total sample is 0.81.

5.2 Differential Effect of Gender on Teaching Competency

The data and result of the independent sample t-test performed to compare the male and female teacher trainees with respect to their teaching competency are given in Table 2.

Table 2: Comparison of the Teaching Competency of Male and Female Teacher Trainees

Groups	Statistical Indices				t-value	Level of Significance
	N	M	SD	SE$_M$		
Male	136	133.95	19.731	1.692	7.729	.01 Level
Female	346	120.82	15.471	.832		

Comparison of the mean scores of teaching competency of male and female pre-service physical science teachers produced a t-value which is significant at 0.01 level (t = 7.729; p<0.01). It indicates that the male and female trainees differ significantly in their professional competency. Scrutiny of the mean PCST scores reveals that compared to the female teacher trainees (M = 120.82), the male teacher trainees (M = 133.95) are more competent in teaching.

5.3 Differential Effect of Residential Locale on Teaching Competency

The mean PCST scores for pre-service physical science teachers from rural, urban and semi-urban areas were compared by employing one way ANOVA. The summary of the ANOVA is given in Table 2.

Table 2: Comparison of the Teaching Competency of Teacher Trainees from Rural, Semi-urban and Urban Areas (Summary of ANOVA)

TC	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5682.391	2	2841.196		
Within Groups	146263.758	479	305.352	9.305	.001
Total	151946.149	481			

The F-value obtained on comparing the teaching competency scores of pre-service physical science teachers from different residential locale is significant at 0.001 level. It exposes that, teacher trainees from rural, semi-urban and urban areas differ significantly with regard to their professional competency. In order to find out whether the observed difference exist significantly among all the pairs compared, Scheffe's post hoc test was performed and the results are given in Table 3.

Table 3: Post Hoc Tests for Comparison of Teaching Competency of Teacher Trainees from Rural, Semi-urban and Urban Areas

(I) LOC	(J) LOC	(I-J) Mean Difference	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
RURAL	Semi-urban	-3.663	2.056	.205	-8.71	1.38
	Urban	-8.026*	1.868	.000	-12.61	-3.44
SEMI-URBAN	Rural	3.663	2.056	.205	-1.38	8.71
	Urban	-4.363	2.279	.161	-9.96	1.23
URBAN	Rural	8.026*	1.868	.000	3.44	12.61
	Semi-urban	4.363	2.279	.161	-1.23	9.96

* The mean difference is significant at the 0.05 level.

The results of the *post hoc* test for multiple comparisons between means of Teaching Competency of teacher trainees from different residential locales show that the observed significant difference is limited to one pair combination of areas compared, i.e., between Rural and Urban locales (mean difference = 8.026; p<.001). No significant difference was found to exists between teacher trainees of Rural and Semi-urban areas (mean difference = 3.663; p>.05), as well as between Semi-urban and Urban areas (mean difference = 4.363; p>.05). Inspection of the estimated mean differences for the rural-urban pair reveals that the pre-service physical science teachers from urban areas excel their counterparts from rural areas in their teaching competency. Teachers from the rural areas, however, are almost similar to their fellow students from semi-urban areas; and the trainees from urban areas are alike their colleagues from semi-urban areas in their professional competency.

5.4 Differential Effect of Entry Qualification on Teaching Competency

The mean teaching competency scores estimated for pre-service physical science teachers with graduation and post-graduation as their entry level qualifications were compared to find out whether the groups are alike in their professional competency. The result of the t-test carried out is given in Table 4.

Table 4: Comparison of the Teaching Competency of Graduate and Postgraduate Teacher Trainees

Groups	Statistical Indices				t-value	Level of Significance
	N	M	SD	SE_M		
Graduate	247	122.68	17.828	1.134		
					2.345	.05 Level
Postgraduate	235	126.46	17.545	1.145		

The t-value obtained is significant at .05 level, showing that graduate and post-graduate pre-service physical science teachers differ significantly in their teaching competency. Inspection of the mean values estimated for the groups reveals that teacher trainees with postgraduate degrees excel their colleagues with graduation alone in their professional competency.

5.5 Differential Effect of Socio-Economic Status on Teaching Competency

The professional competency of pre-service physical science teachers from high-, average-, and low socio-economic status were compared by applying one way ANOVA to find out significant difference among the groups. The sumamry of the analyses carried out in this context is presented in Table 5.

Table 5: Comparison of the Teaching Competency of Teacher Trainees from High-, Average-, and Low SES (Summary of ANOVA)

TC	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	493.034	2	246.517		
Within Groups	151453.115	479	316.186	.780	Not significant
Total	151946.149	481			

The F-value obtained on comparing the teaching competency of pre-service physical science teachers from high-, average-, and low socio-economic status is not significant (F = 0.780; p>.05). It shows that no significant difference exists among teacher trainees from different socio-economic status regarding their professional competency. To put differently, socio-economic status is not a significant factor in discriminating pre-service physical science teachers on the basis of their teaching competency.

1.1 Differential Effect of Academic Achievement on Teaching Competency

The pre-service physical science teachers with high-, average-, and low achievement were compared to see whether they differ significantly in their teaching competency by subjecting the data to one way ANOVA. The results of the analyses done in this context is given in Table 6.

Table 6: Comparison of the Teaching Competency of Trainees with High-, Average-, and Low Achievement (Summary of ANOVA)

TC	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5690.681	2	2845.340		
Within Groups	146255.468	479	305.335	9.319	.001
Total	151946.149	481			

The F-value obtained on comparing the teaching competency of trainee teachers with different levels of achievement is significant (F = 9.319; p<.001). It shows that pre-service physical science teachers with high-, average-, and low levels of achievement differ significantly in their professional competency. Intergroup comparisons of the obtained differences between high-, average-, and low achievers were further carried out to find out whether the obtained significant differences exist between all the pairs of groups considered. The result of the *post-hoc* multiple comparisons made in the context is given in Table 7.

Table 7: Post Hoc Tests for Comparison of Teaching Competency of Teacher Trainees with High-, Average-, and Low Achievement

(I) ACH	(J) ACH	(I-J) Mean Difference	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
LOW	Average	-6.705*	1.854	.002	-11.26	-2.15
	High	-9.033*	2.330	.001	-14.75	-3.31
AVERAGE	Low	6.705*	1.854	.002	2.15	11.26
	High	-2.328	2.107	.544	-7.50	2.85
HIGH	Low	9.033*	2.330	.001	3.31	14.75
	Average	2.328	2.107	.544	-2.85	7.50

* The mean difference is significant at the 0.05 level.

The results of Scheffe's post-hoc test of multiple comparisons exposes that the mean difference obtained on comparing the teaching competency of different paired combinations of the high-, average-, and low achieving teacher trainees indicate the following: (i) the Low and Average achievers differ significantly in their professional competency (mean difference = 6.705; p<.01), (ii) significant difference exists between Low and High achieving pre-service physical science teachers (mean difference = 9.033; p<.001), the Average and High achieving trainee teachers are almost alike in their teaching competency (mean difference = 2.328; p>.05).

6. CONCLUSIONS

The results of the analyses showed that socio-demographic factors such as gender, residential locale, entry level educational qualification, and level of academic achievement have significant differential effect on teaching competency of pre-service physical science teachers. The hypotheses formulated in this context, viz., H_01, H_02, H_03, and H_05 are, therefore, rejected. No significant effect of socio-economic status of the family was observed in the teaching competency of pre-service physical science teachers.

The hypothesis formulated in this regard, viz., H_04, is, hence, accepted. To conclude, socio-demographic factors are decisive in the teaching competency of pre-service physical science teachers, and hence these aspects should also be taken into consideration while recruiting teachers.

7. IMPLICATIONS OF THE STUDY

The present study disclosed the presence of a significant difference between male and female teacher trainees with regard to their teaching competency. It was found that the female teachers trail behind their male counterparts in their professional efficiency. Considering the fact that almost 90 percentage of the students seeking admission to our teacher education institutions for getting professional training for teachers are ladies, cardinal changes need to be brought about in the way prospective teachers are equipping. The rural-urban divide in teaching competency is evident from the present study. Another revealing finding of the study is that the pre-service physical science teachers with post-graduation excel trainees with graduation only in their teaching competency. Recruiting trained postgraduates to school system as teachers will have its beneficial effect on the learning outcome of school children. Policy levels decisions are needed to recruit trained postgraduates at a better pay scale as secondary school teachers for getting the service of more competent teachers in schools. The significant difference observed in the teaching competency of high-, average-, and low achieving teacher trainees underlines the need for enriching the theoretical knowledge of core subjects as well as pedagogy for becoming competent teachers.

8. ACKNOWLEDGEMENTS

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