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Study of Science Teachers' Perception and Students' Application Ability of Physics Concepts

[1]Munir Khan, [1,2]Muhammad Naseer Ud Din and [1]Ishtiaq Hussain

[1,2]Institute of Education and Research, Kohat University of Science and Technology, Pakistan
[2]School of Education, University of Glasgow

Abstract: Secondary school students mostly memorize the facts, laws, principles and concepts and recall it in examination. This study aimed at to assess the ability to which the secondary school science students can apply physics concepts in familiar and unfamiliar problem situation. Perceptions of Physics' teachers toward the performance of Secondary school science students in Physics class were considered as one of the factors influencing the application abilities of the students. Causal relationship was explored between the physics concept application abilities of the secondary school science students and the Physics teachers' perceptions. The students' application abilities of physics concepts measured on concept application ability test were found as 33 %, a significantly low performance. The private sector Students performed remarkably better than the public sector students and no significant difference was found between the performance of boys and girls students. The over all comparison of public and private sectors secondary school Physics teachers' perceptions toward students' performance in Physics class room showed no significant difference. Positive and non-significant causal relationship was explored between students' physics concept application abilities in terms of score on concept application ability test and the Physics teachers' perceptions toward science students' performance in class.

Key words: Physics teachers' perceptions · Students' application abilities of physics concepts · Causal relationship

INTRODUCTION

The science education makes efforts to adopt science as a method of study, hands on as well as mind on activity which may cause development of conceptual understanding, concept application ability, scientific literacy andscience process skills, as a result the students would make sense of the physical world. The factors contribute to learning and quality of achievement of students are parent education, occupation, support and expectation, number of siblings, socio-economic status, home environment, culture, demographic variable, school factors, students perception, attitude, study habits, thinking skills, time for additional study, home work, self concept, interest, learning style, gender differences, motivation, attitude toward the subject, nature of science and teacher characteristics [1-10]. Family factor, students' characteristics and school environment affect performance of students in science [11]. School management, family involvement and students' characteristics were the aspects related to students' achievements, where students' characteristics included "additional study time, critical thinking, science process skills, family variables such as parental support and expectation" [12]. Examination system, factual nature of teaching, quality of text and curriculum are also the hurdles in the way of conceptual understanding [13-17]. There are wide variety of interacting factors give input to the acquisition of learning outcomes, for example, the student bring intellectual, social and emotional frame of thoughts from home and the surrounding environment to the school environment of certain peculiar attributes just as a product of interaction of students, teachers, management and activities [18]. Improved learning environment, method and characteristics of teacher proved helpful in promotion of critical thinking among students [19].

Concept Is Defined As: A set of rules to categorize and group events, an abstraction of series of experiences [20], an idea of an object or event [21, 22] the characteristics which classify together or set apart two things [23].

Corresponding Author: Munir Khan, Institute of Education and Research, Kohat University of Science and Technology, Pakistan

Concept Formation Is: Insured when one can apply it [24, 25], depending on the capacity to learn and can be affected by environment [26], a result of interaction with society, home andcommunity [27]. When the student can apply the concept in a varying context, then it is claimed that the student has understood the concept. Misconception is the flawed view of how the world works [28].The information can be recalled but cannot be applied andcannot relate the real and model, named as "inert knowledge" [29]. 'Concept as unit of knowledge in science has a unique role to explain natural phenomenon" [30].

Physics interpret the world around us in a specifically known language at three thought levels, the macro, the micro andthe symbolic. Sometime it becomes difficult for students to work at the three levels simultaneously andhence, they are compelled towards memorization. The main thing in the study of Physics is the concept development. In the context of Physics, by concept we mean the contents, which make Physics distinguishable. Conceptual understanding is very rare when the instruction in Physics focuses on drilling a standard problem in fixed order, the sign is learned instead of the concept and a gap is produced between scientific practice and science as a subject of formal nature [31]. Student get Physics and the world between their own way of thinking and what the teacher as well as the text say [32].

Method and Procedure: This was a descriptive, comparative as well as causal comparative study. Multistage sampling was used to choose sample of Secondary school science students, SSSS (N=1840) and science teachers who teach Physics (N=92) from all the secondary level public and private, girls and boys secondary schools in the sampled 5 districts out of 25 districts of Khyber Pakhtunkhwa, Pakistan. Medium of instruction, text and examination is English in the private schools while the same are in Urdu in the public schools. The students' physics application abilities were measured on concept application ability test (CAA test) which included 30 items of various forms, MCQ, information grid type and short answers supply type Questions. About 50% of the items of the CAA test were adopted by Al-Ahmadi (2008) [33] and the remaining items were developed by the researcher. The test was validated by experts' judgment and its Cronbach's alpha reliability coefficient was 0.7. The test was personally administered by the researcher among all the randomly chosen schools, sixteen from each district in the sampled five districts, Malakand, Mardan, Peshawar, Kohat and DI Khan. The score for each item on CAA test was not uniform and was converted into one for analysis. Questionnaires were distributed among the teachers who teach physics (N=92) in the sampled unit schools in order to investigate their perceptions toward the student's performance in Physics class. The CAA test score of students was analyzed by mean and independent sample one-way and two-way t-test. The Physics teachers' perceptions toward the students' performance in Physics class were measured on five point Likert scale and two ways contingency tests was implied to its analysis and comparison. The teachers' questionnaire data point values (5, 4, 3, 2.and 1) for (SA, A, N, DA andSDA) were considered as score for the exploration of relationship between CAA test score and the teachers perceptions. Multiple regression analysis was used to explore the relationship between students' physics concepts application abilities score and the Physics teachers' perceptions toward the students

RESULTS

The table 1 describe that the major purpose of the study was to assess the students' concept application abilities in Physics at secondary stage. The SSSS mean score performance, 10 out of 30 on C & T test shown in table 1 reveals that the students can apply the Physics concepts in problem situation up to 33 percent, which is significantly less than the average.

As discussion of table 2 With reference to educative facilities and administrative setup, the public and private sector schools are two different systems. According to table 2 the comparison among the SSSS' score obtained on C & T test reveals significantly better performance in favor of private school systems. The boy SSSS comparatively show better performance on the C & T test and the difference is non significant. It is highly appreciable that the girl students can apply Physics concepts in the capacity comparable to boy students.

Table 3 shows about the overall comparison of perceptions among public and private sector Physics teachers regarding the performance of SSSS in the Physics class which is not significant except for two items; one is related to questions asked by few students in class and the public sector Physics teachers are more in percentage in this regard. The second item is about the completion of assignments by students and the private sector Physics teachers are more hopeful in this connection. The percentage of public sector Physics teachers is higher in the items, 'the students are free to talk and make groups', 'few students ask' and

Table 1: Score of Secondary School Science Students on CAA test

N	Total Test score	Mean	Std. Deviation	t	P
1846	30	10.1	3.4	-60.75	< 0.01

Table 2: Sector and gender wise score of SSSS on Concept application ability test

Sector	N	Mean	Std. Deviation	Mean Difference	P
Public	910	9.4	3	-1.5	< 0.01
Private	936	10.9	3.7		
Boys	1401	10.2	3.7	0.27	n.s
Girls	445	9.9	2.6		

Table 3: Perceptions of Physics teachers about performance of students in classroom

All as % (NPublic = 47, NPrivate = 47)		SA	A	N	DA	SDA	x^2 (df)	p
The students are free to talk with each other when needed during teaching	Public	34	25	11	21	9	5.9 (4)	n.s
	Private	13	32	15	30	11		
	Total	23	29	13	25	10		
The students are not free to move anywhere in the class	Public	14	21	14	27	25	6.0 (4)	n.s
	Private	9	7	13	28	44		
	Total	11	13	13	28	34		
The students are free to form groups for teaching learning process	Public	41	24	13	11	11	7.3 (3)	n.s
	Private	28	30	22	20	0		
	Total	35	27	17	15	5		
The students are free to ask questions at the end of teaching only	Public	42	31	13	13	0	3.2 (3)	n.s
	Private	53	22	18	4	2		
	Total	48	27	16	9	1		
Few students ask questions in the class	Public	7	4	7	46	37	12.3 (3)	< 0.01
	Private	2	19	23	36	19		
	Total	4	12	15	41	28		
The students are keen to learn	Public	21	30	30	21	0	3.8 (3)	n.s
	Private	21	45	26	9	0		
	Total	21	37	28	14	0		
Most students complete the assignments on time	Public	20	24	17	30	9	12.5 (3)	< 0.01
	Private	9	36	40	15	0		
	Total	14	30	29	27	4		
The students tend not to participate in the teaching and learning process	Public	9	41	27	18	5	4.2 (3)	n.s
	Private	2	55	16	21	7		
	Total	6	48	22	19	6		
The students seem enthusiastic about physics	Public	5	38	43	12	2	2.0 (3)	n.s
	Private	4	24	56	13	2		
	Total	5	31	49	13	2		

Table 4: Relation between SSSS' score on C & T test and Physics teacher perceptions toward students' performance in Physics classroom

Predictors	Std. Error	Beta	t	Sig.	R	R-Square	F	Sig.
The students are free to talk with each other when needed during teaching	0.22	0.10	0.68	0.50	0.31	0.10	0.80	0.62
The students are not free to move anywhere in the class	0.19	-0.11	-0.92	0.36				
The students are free to form groups for teaching learning process	0.27	-0.08	-0.51	0.61				
The students are free to ask questions at the end of teaching only	0.29	0.08	0.62	0.53				
Few students ask questions in the class	0.24	0.21	1.71	0.09				
The students are keen to learn	0.30	0.01	0.05	0.96				
Most students complete the assignments on time	0.26	0.02	0.19	0.85				
The students tend not to participate in the teaching and learning process	0.26	0.18	1.39	0.17				
The students seem enthusiastic about physics	0.32	0.03	0.21	0.84				

Dependent Variable: Students Test Score (30)

'the students seem enthusiastic about Physics. All these four except 'few students ask' are the valuable and mutually consistent views about the students centered pattern of classroom. The percentage of private sector Physics teachers is better in five items; 'the students are not free to move', 'the students can ask at the end of lesson only', 'the students are keen to learn', 'completion of assignments' and'students tend not to participate'. The private sector teachers are less trained and less experienced and they are in the favor of teacher centered and autocratic pattern of teaching and learning process in classroom. On the other hand, according to table 2 of this study, the private sector students performed better in the form of score obtained on C & T test as well as in the board external exams.

According to table 4, the teachers' perception on 'students are not free to move in the class' is negatively related with students' concept application abilities in terms of score on C & T test. The statements 'few students ask questions' and 'the students tend not to participate' are positively related with SSSS score on C & T test. It means that the teachers are not satisfied from the participation of students. R-Square value of 0.10 reveals that these predictors collectively accounted for ten percent in the variation in the SSSS score on C & T test. F (9, 94) = 0.8, p = 0.62 shows that these predictors contribute non-significantly to the SSSS score on C & T test.

DISCUSSION

The secondary school science students' performance on concept application ability test in the form of application abilities of Physics concepts in problem situation was found as 33%, agreed with the findings that most of the students cannot get the functional understanding of the Physics concepts [34], the teaching does not focuses over concept clarification [35] and thinking development [36]. The implemented National curriculum (2000) for Physics grade 9&10 reserved 10% contents for the development of application abilities and 55% for knowledge contents. [37 and 38] concluded that scientific thinking is not possible to develop at the secondary level even in higher classes with out targeted teaching. The results of the study in hand also reveal that private sector students obtained remarkably better score on CAA test as compared to public sector students and no significant difference was found between the performance of girls and boys students stood in line with [39] and argued against the finding that the Knowledge of Physics concepts of boys is significantly lower than girls.

While the overall comparison of perceptions among public and private sector Physics teachers regarding the performance of SSSS in the Physics classroom showed no significant difference. The private sector physics teachers are in the favor of teacher centered and autocratic pattern of teaching and learning process in classroom. The multiple regression analysis showed no significant effect of Physics teachers' perception on students' performance in the form of score obtained on concept application ability test while teacher characteristics [40, 41], ineffective role of teacher [42, 43] and untrained teacher [44] is one of the causes of students poor performance and failure in science and at the same time the finding agreed with the results of the previous study [45-48].

CONCLUSION

The secondary school science students particularly public sector students showed significantly low performance when their ability to which they can apply Physics concept in problem situation was tested on Concept application ability test conducted by the researcher. And no appreciable difference was found between the perceptions of public sector and private sector physics teachers toward students' performance in physics classroom. According to multiple regression analysis, the influencing factors related to Physics teacher perceptions toward students' performance in Physics class room contribute no significant effect to the students' performance in the form of Physics concepts application ability on concepts application ability test. So, it is concluded that the Physics teacher perceptions toward students' performance in physics classroom had no significant effect on the students' concept application ability in Physics at secondary level.

Looking into the results of the study with reference to the Physics teacher's perceptions toward the performance of students in physics classroom, which is suffering due to the application of students, centered teaching and learning process of education which are suitable for conceptual understanding and development of concept application ability. All the Physics teachers particularly that of private sector teachers has the need to be trained in the issues relating to student centered and more conducive environment for conceptual development in Physics and other science subjects. Government, school, parent teacher councils, non-government organizations, teacher unions and printed literature can be used for this purpose of training and awareness of science and Physics teachers.

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