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A COMPARATIVE STUDY OF BASIC SCIENCE PROCESS SKILLS OF SCIENCE STUDENTS AT HIGHER SECONDARY LEVEL IN DISTRICT RAWALPINDI, PAKISTAN

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ABSTRACT

Science process skills (SPS) had a pivotal role in scientific investigation. SPS are very important to be developed in science learning because with the help of SPS students develop their thoughts to make discoveries using scientific investigation. In the 21st century SPS are needed in science learning. In Pakistan results of many studies showed that private sector institutes' students were performing better than the public sector institutes' students in the subject of science. Better performance in science is only possible when students have a high level of science process skills. The main purpose of this study was to determine students' level of performance on basic science process skill and to compare the performance of public and private school Physics students in science process skills at the H.S.S.C. level. A Simple comparative research design was used to compare the skill level of students. In the present study four aspects, of basic science process skills (Observation, Communication, Measurement, and Relationship) were observed. Through purposive sampling technique two top-level colleges, one from the public school system and one from the private school system of the city of Rawalpindi, were selected for the study. For data collection researcher used an observation sheet and worksheet based on four experiments of physics at higher secondary school certificate level. Measurement of SPS was done when students were performing experiments in practical labs. t-test was employed to compare the performance of public and private school students. The result of the research stated that there was a significant difference in basic science process skills of public and private school physics students at the H.S.S.C level. The mean score of performance of public and private school students was observed to be good in the aspects of observation and relationship skills but still teachers need to improve the performance of students in the aspects of communication and measurement skills. Further it is recommended that exam system may give more weightage to science process skills so that students and teacher of science subjects may be able to concentrate more on this aspect of learning.

Keywords: basic science process skills; scientific investigation; science learning

INTRODUCTION

The process of science includes scientific attitudes and methods of inquiry. Scientific attitude shows curiosity, determination, open- mindedness, objectivity and rationality whereas the method of inquiry is based upon skills such as observing, hypothesizing, analyzing, inferring, reasoning and synthesizing. According to Mutlu and Temiz (2013) "Science process skills (SPS) are the basis for scientific thinking and research". Tobin and Capie (1982) described that SPS are the abilities of an individual to identify a problem, make a hypothesis, give a prediction, identify and define the variables, test the hypothesis, collect data, analyse data and introduce logical findings. Science process skills associate science knowledge with real-life events in science education (Michaels et al., 2008). Science process skills (SPS) facilitate learning through practical activities and methods of research along with the development of scientific knowledge Rustaman

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(2003) considered science process skills as a tool which an individuals can use to get the most out of their knowledge.

Science process skill is not only considered a learning approach but also used to determine the outcome of learning. llma et al. (2020) found a significant correlation between students' SPS and biology cognitive learning outcomes. Learning in the subject of Physics is not only used to comprehend the concepts of Physics but also to master 21st century skills. The curriculum emphasized learning activities in the laboratory to develop science process skills. According to Nyakiti et al. (2010), content knowledge instructed in science classrooms should act as a source to grow and enhance science process skills. Science laboratories role is very important in science learning and the development of SPS. The key role of science labs is to develop SPS in students (Trowbridge et al., 2000). Moreover, Osborne and Dillon (2008) state that science labs plays a pivotal role in the process of imparting and gaining knowledge of science and assist to grow the students' concepts of scientific processes and understanding. Science process skills facilitate learning in science, permit learner to be dynamic, energetic and active, providing a theme of authority and responsibility and improving the achievement of students in learning (Bati et al., 2010). Labs have a key role in the development of SPS in science students. Experimental as well as virtual labs can be used to develop SPS. According to Safitri (2020) students using virtual labs had a greater percentage achievement in science process skills as compared to students using the experimental lab. According to Yamtinah (2017) schools also influence the SPS of students.

Science process skills reflect learning abilities and dispositions that students required to be developed in themselves to prepare for dynamic society linked with technology. SPS are part of higher-order thinking (HOT) skills and HOT is based upon these skills. These skills are the skills of the 21st century. Maison et al. (2019) concluded that SPS are very important for the learner. According to Zeidan and Jayousi (2015) when the children understand the SPS, science becomes more interesting. Knowledge consists of facts, concepts laws, experiments, hypotheses and theories. Scientific knowledge is only one component of science. Another component of science, equally important to scientific knowledge, is the process of doing science. Scientific knowledge is obtained through the scientific process. To figure out every day problems in life we use scientific processes and in this way, we can construct and solve problems of daily life. Moeed (2013) quoted the description of scientific method made by Bradley (2005) as a series of different steps which include: observation, defining the problem, collecting data which is reliable, formulating a hypothesis for explaining facts and data, testing the hypothesis through experiment, and drawing a conclusion.

In the scientific process, scientists tried to accumulate evidence that is observable and measurable. So keen observation plays an important role in the scientific process. Science is often learned through observation, language and vocabulary (Shaughnessy et al., 2017). According to Shaughnessy et al. (2017) many students do not understand the concepts of science, variables, and types of variables involved in experiments, even students confuse about the terms and have forgotten the most silent and critical terms involved in experiments. A scientific investigation is a way of asking questions and seeking a possible answer to those questions. A scientific investigation typically starts with observations. As a result of observation, questions arise and students try to find the possible logical answers to those questions. Answering questions is based on scientific knowledge. According to Abrahams and Millar (2008) students required both understandings of scientific concepts and the application of skills for a successful scientific investigation.

Practical work is a very important aspect of science learning. According to Sani (2014) laboratory work is just experimenting to confirm the truthiness of already-known theory. School laboratories are not used to find new things that had not been known previously. There are many reasons for doing practical work in school. Shana & Abulibdeh (2020) mentioned the reason described by Dillon (2008), that practical work maintains the interest of students in science and promotes logical and rational thinking in students. Idiege et al. (2017) mentioned that learning science from childhood to adulthood starts with the development of process skills. This is because SPS are used as a tool that encourages students to perform the different tasks that would lead them to reflective practices and reflective thinking for the creation of new knowledge.

According to Shaughnessy et al. (2017) five skills i.e. interpretation, evaluation, analysis, inference and explanation are important for students when they obtain information from their experiments. In interpretation skills, students draw inferences and summarize their results. Evaluation skill demands that students must think logically, empirically, scientifically and vigorously. Through analysis skills students assess the logical interrelationship among the facts from various experiments whereas through inference students perceive implications from the results of

the experiments. Explanation enable students to present information understandably. The explanation can only be possible if students communicate properly.

A qualitative research study was conducted by Rustan et al. (2019) in elementary schools in Surakarta city in Indonesia to make an analysis of SPS in science learning. The results of the study showed that the SPS of students are relatively low and it is because teachers do not conduct experiments in science teaching. In a research study, Sholihah et al. (2020) found that the ability to science process skills in 4 medium state senior high school students was low with a percentage of 47%. Inayah et al. (2020) the highest skills possessed by the students are experimental skills while the skills in measuring and communicating are the lowest skills possessed by students. Jack (2018) investigated the influence of gender and class size on chemistry students' science process skills in Nigeria by using Science Process Skills Knowledge Test in Chemistry (SPSKTC). He found that gender has negligible influence on the SPS of students whereas large class size greatly affects the students' science process skills.

Currently, in Pakistan, two different systems of education are working i.e. public and private schools. Private schools perform well as compared to public schools. In a comparative study, Iqbal (2006) found that private school teacher used all their available resources as compared to public school teachers. On the other hand, Farooqi et al. (2015) reported that govt. schools have better Physical facilities as compared to private schools. Despite better facilities, public schools student do not get better results in Science. So it is very important to explore the performance of both systems in the context of BSPS. According to the research study of Akhter (2017) parents in Pakistan have thinking that private school teacher create a conducive environment in the classroom and they agreed that private schools have updated and functional laboratories. Functional and updated laboratories may help students in the development of SPS. So one reason behind this research study was to explore the performance of the private school in science process skills to verify the thinking of parents about private schools. Yamtinah (2017) in his research study quoted that science learning and development of science process skills are two integrated things. So in science learning, the basic science process skills of students play a very important role. One rationale behind this research study was to determine the skill level of both type of students to know the shortcoming in the development of BSPS. Therefore this research study will explore the BSPS of students studying Physics at an intermediate level in a different system (public and private) of schools in the City of Rawalpindi.

This research intended to attain the following objective. To compare the performance in basic science process skills of public and private schools Physics students at the HSSC level. Research question: is there any difference in the performance of public and private school students in basic science process skills?. Hypothesis tested during this study was: H0: There is no statistically significant difference exist in Basic Science Process Skills of public and private schools Physics students at the HSSC level.

METHODS

The design used for this research study was a simple comparative research design. Public and private school students were examined and their performances were compared in terms of science process skills at the HSSC level in the city of Rawalpindi. In the first stage of research, the researcher selected two top-level colleges, one from the public sector and one from the private sector, of the city of Rawalpindi. Colleges were selected based on the last three years results in the subject of physics. In the second stage researcher selected four experiments from the physics syllabus at the HSSC level. The experiments selected for the development of the tool were: (1) Frequency of AC by Melde's Apparatus; (2) Investigation of the laws of vibration by sonometer; (3) Variation of resistance of the thermistor with temperature; (4) Finding the relationship between the current passing through the tungsten filament lamp and the voltage applied across it. In the third stage two research instruments, an observation sheet and a work sheet were developed for data collection. The observation sheet and worksheet comprise 78 items related to four experiments in Physics. In the fourth stage researcher administered the instrument for data collection.

The population of the research study was male grade XII Physics students of pre-engineering and pre-medical groups of public and private sector colleges of the city of Rawalpindi. A breakdown of this figure shows that 714 Physics students were studying in 08 Public Sector Colleges and 1950 students were studying in 11 private sector colleges. Through purposive sampling technique two top-level colleges, one from public sector and one from the private sector, of the city of Rawalpindi were selected. Then researcher used a random sampling technique to select 30 students of Physics from each college as the sample of the research study. So the sample of the study was 60

students, 30 students from Govt. College Asghar Mall Rawalpindi and 30 students from Kips College Chandni Choke Rawalpindi, of two top-level colleges of city Rawalpindi.

The researcher used two research instruments (An observation sheet and a worksheet) for data collection. An Observation sheet and worksheet were prepared for four experiments of Physics in which basic aspects of SPS were present. These tools were administered to 60 students, 30 students from Govt. College Asghar Mall Rawalpindi and 30 students from Kips College Chandni Choke Rawalpindi. The observation sheet was prepared on 5 point Likert scale. Whereas for worksheet rubrics criteria was prepared by the researcher for grading worksheet. The Reliability of both instruments was ensured through pilot testing. The reliability coefficient for the observation sheet was found to be 0.924 and it was 0.927 for the worksheet. The validity of both instruments was also ensured by taking expert opinion. The observation sheet was revised in light of suggestions given by the experts. The work sheet was also validated by using a validation sheet. Experts were asked to rate each item according to the criteria given on the validation sheet.

The researcher applied a rigorous approach to the measurement of SPS. For this purpose researcher used observation sheets and worksheets of SPS activities for the collection of data. The researcher collected data related to four aspects of basic science process skills (SPS) i.e. Observation, Communication, Measurement, and Relationship, to compare the performance of public and private school students in SPS. The researcher observed the students' performance in basic science process skills when they were performing experiments in practical labs. The Researcher also provided a worksheet to each student and asked them to complete it during experimentation.

RESULTS AND DISCUSSION

Data collected through research instruments were analyzed by using inferential statistics. t-test was employed through SPSS version 20. An independent sample t-test was used to find the significant difference in the performance of public and private school students in SPS at a significant level of 0.05.

For the interpretation of data, the researcher developed interpretation criteria to interpret the results obtained through this study. This idea was taken from the research study of Hariapsari et al. (2018). Students' performance in science process skills was categorized into five different levels according to their mean score of performance in science process skills. If the mean score of performance lies between 1 to 1.80 this indicates a very low skill level. If the mean score ranges from 1.81 to 2.60 this indicates low performance. The third slab of mean scores i.e. 2.61 to 3.40 represents the fair performance of students in SPS. If the score lies between 3.41 to 4.20 this indicates a good skill level of performance and the 4.21 to 5.0 score range indicates an excellent level of performance in science process skills.

This research study was different from other studies as two research instrument an observation sheet and a work sheet were used for the collection of data. Both the worksheet and observation sheet were synchronized and developed in the same pattern. In other research studies like study of Nugraha et al. (2019) researcher selected only one experiments and used only a worksheet whereas in this research study researcher selected four experiments from physics syllabus. So this research study was different from other studies because public and private school students' basic science process skills were compared by using two research instruments. For analysis the researcher analyzed data in four aspects of basic science process skills. After that researcher calculated the mean score of performance in basic science process skills by calculating the mean of four aspects.

The researcher analyzed the students' performance in observation skills to determine the performance difference between public and private school students in observation skills. The comparison of students' performance in observation skill is shown in table 1.

Table 1. Comparison of Public and Private School Students' Performance in Observation Skill Measured Through Observation Sheet and Worksheet

SPS Aspects	Research Instrument	Type of School	N	Mean	SD	SEM	t	DF	Sig. (2 tailed)
Observation Skill	Observation Sheet	Public	30	3.63	0.56	0.103	-3.25	58	0.002
		Private	30	4.07	0.49	0.090			
	Worksheet	Public	30	3.61	0.55	0.101	-3.14	58	0.003
		Private	30	4.05	0.51	0.093			

Level of significance p= 0.05

Table 1 shows that there is a significant difference (P<0.05) between public and private school Physics students' performance in observation skills. The mean score of 4.07 of private school students is greater than the mean score of 3.63 of public school students which shows that the performance of private school students in observation skill is better than the public school students, It is seen from the table that means score value for both groups is greater than 3.4 which shows both groups performed well in the process skill of observation and their observation skill level of performance was good. Results of table 1 show that students of both public and private schools have a high level of observation and to great extent they can observe different parameters of the experiment.

Through worksheet observation skill of both public and private school was also measured. No significant difference exist between the results of two instruments. The same results as that obtained through the observation sheet has been found when researcher used a worksheet to determine the performance of students in observation skill. The p value obtained through the worksheet was found to be 0.003 < 0.05 which shows that there is a significant difference exist between public and private school students' performance in observation skill. The researcher analyzed the students' performance in Communication skills to determine the performance difference between public and private school students in Communication skills. The comparison of students' performance in Communication skill is shown in table 2.

Results of table 3 revealed that there is no significant difference (p= 0.633> 0.05) between public and private school Physics students' performance in communication skills. The mean value for both groups is nearly equal to 3 which lies in the range of 2.61-3.40 this shows that students' communication skill level was fair and to some extent students of both public and private school were able to describe the apparatus, procedure and physical phenomena of the experiments. Through worksheet communication skill of both public and private school students was also measured.

Table 2. Comparison of Public and Private School Students' Performance in Communication Skill Measured Through Observation Sheet and Worksheet

SPS Aspects	Research Instrument	Type of School	N	Mean	SD	SEM	t	DF	Sig. (2 tailed)
Communication Skill	Observation Sheet	Public	30	3.08	0.59	0.109	0.481	58	0.633
		Private	30	3.00	0.79	0.145			
	Worksheet	Public	30	3.03	0.59	0.108	0.415	58	0.680
		Private	30	2.96	0.79	0.144			

Level of significance p= 0.05

The results obtained through the worksheet also indicated that there was no significant difference between public and private schools students' performance in communication skills however significant differences exist between the results of the two instruments. The overall mean score of students obtained through the observation sheet was higher than the worksheet. It was surprising for the researcher and it might be due to the inability of students to comprehend the instructions given on the worksheet. This study also compared the measurement skills of public and private school students. Student's measurement skill was measured through both observation sheet and worksheet. Table 3 shows the comparison of public and private school student performance in measurement skill measured through observation sheet.

Table 3. Comparison of Public and Private School Students' Performance in Measurement Skill Measured Through Observation Sheet and Worksheet

SPS Aspects	Research Instrument	Type of School	N	Mean	SD	SEM	t	DF	Sig. (2 tailed)
Measurement Skill	Observation Sheet	Public	30	3.12	0.63	0.115	-2.41	58	0.036
		Private	30	3.52	0.81	0.149			
	Worksheet	Public	30	3.06	0.63	0.115	-2.11	58	0.038
		Private	30	3.46	0.79	0.144			

Level of significance p= 0.05

Table 3 conveys that there was a significant difference ($p<0.05$) between public and private school students' performance in measurement skill. A closer look at the result revealed that Physics students from private schools had a higher mean value than those from public school in measurement skill. The mean score of 3.52 indicates that Physics students of private school had enough ability to measure different parameters of experiments correctly and their measurement skill level of performance was good whereas the mean score of 3.12 shows that public school students had average ability to measure different physical quantities associated with experiment. As mean score 3.12 of public schools lies in the range of 2.61to 3.40 which shows that their measurement skill level of performance was fair. This result was consistent with the result of the study of Inayah et al. (2020). Through worksheet, measurement skill of both public and private school was also measured. This result revealed that there was a significant difference in public and private school students' performance in measurement skills. A significant difference was also found between the results of the two instruments. The mean score of performance measured through the observation sheet was greater than the mean score of performance measured through the worksheet. Again it might be due to the inability of students to comprehend the instructions given on worksheet. The comparison was also made in the case of relationship skills. Comparison is shown in table 4.

Table 4. Comparison of Public and Private School Students' Performance in Relationship Skill Measured Through Observation Sheet and Worksheet

SPS Aspects	Research Instrument	Type of School	N	Mean	SD	SEM	t	DF	Sig. (2 tailed)
Relationship Skill	Observation Sheet	Public	30	3.47	0.67	0.123	-2.06	58	0.044
		Private	30	3.92	1.00	0.183			
	Worksheet	Public	30	3.52	0.67	0.123	-1.70	58	0.093
		Private	30	3.90	1.00	0.183			

Level of significance p= 0.05

The data in table 4 indicated that there was a significant difference between public and private schools students' performance in relationship skill. The mean score of performance in relationship skills was higher among private school students than the public school students however it was interesting to note that both public and private school students had enough ability to relate different variables involved in the experiments. The mean score for public school is 3.47 and for private school students 3.92, both lies in the range of 3.41-4.20 which indicates that students' relationship skill level of performance was good among both groups. The researcher also used a worksheet to determine the students' performance in relationship skills. This result shows that there was no significant difference ($p=0.093>0.05$) between Public and Private School Students' Performance in Relationship Skills. It contradicts the result obtained through the observation sheet. A closer look on table 4 indicates that public school students performed well on worksheet assessment as compared to their performance in practical work observed through observation sheet. This difference might be due to the reason that public school students' conceptual understanding was better in the relationship of different variables involved in the four experiments of study.

As observation, communication, measurement and relationship skill are the basic science process skills so researcher has calculated the average score of these four skills for each students and termed them as mean scores of performance basic science process skills. A comparison of the mean score of performance in basic science process skill is shown in table 5.

Table 5. Comparison of Public and Private School Students' Performance in Basic Science Process Skills Determined Through Observation Sheet and Worksheet

SPS Aspects	Research Instrument	Type of School	N	Mean	SD	SEM	t	DF	Sig. (2 tailed)
Basic Science Process Skills	Observation Sheet	Public	30	3.32	0.41	0.076	-2.13	58	0.037
		Private	30	3.63	0.66	0.012			
	Worksheet	Public	30	3.31	0.41	0.075	-1.94	58	0.05
		Private	30	3.59	0.67	0.123			

Level of significance p= 0.05

Table 5 shows that there is a statistically significant difference ($p<0.05$) in basic science process skills of public and private school Physics students at the HSSC level. With this result, the null hypothesis: $\mathbf{H_0}$ "There is no statistically significant difference in Basic Science Process Skills of public and private schools Physics students at the HSSC level" was rejected. This implies that students' school type does have a significant influence on their basic science process skills. A critical look at the mean score of performance reveals that the direction of the significance of basic science process skills is in favour of private school students.

Based on data obtained through the worksheet researcher also made a comparison of basic science process skill of public and private school students. The results obtained through the worksheet indicated that there was a statistically significant difference ($p=0.05$) in basic science process skills of public and private school Physics students at the HSSC level. With this result, null hypothesis $\mathbf{H_0}$ was rejected. A close look at the mean score of performance revealed that private school students' skill level of performance is higher than that of public school students.

The present study was conducted to compare the performance of public and private school students in basic science process skills. The results of the study revealed that for basic science process skills there is a significant difference between public and private school Physics students' performance at the HSSC level. This is somewhat in agreement with Bassey and Amanso (2017) who found that students' science process skill acquisition in public schools differed significantly from their counterparts in a private school in terms of computation and making inference skill. Private school students' performance was better in basic science process skills than the public school students' performance. The better performance of private schools may be due to the following reasons.

Normally the average class size of private school is small as compared to public school. Due to the small class size, students get more attention from their teachers in lab work as compared to public school students. Teachers of private schools give homework which comprises hands-on activities to their students which may increase the performance of students in science process skills. In public school normally no homework was given and if teacher assigned some homework that would not be in the form of hands-on activities. The period for lab work may be one of the reasons for the higher performance of the private school in science process skills because private school students spend more time in lab work as compared to public school students.

About the results of the study student's level of performance was good in the aspects of observation and relationship skills. Students of both types of schools have been able to observe different physical quantities in a precise manner. This is in line with the study of Sunyono (2018) in which he found that students' skill level of observation was high. Students' performance in observation skills was good because observation is a fundamental scientific skill which was developed with the time when students interact with daily life objects, that's why students find it easier to observe different physical quantities involved in the experiments. The results of the study also indicates that type of school influences on the performance of students in the aspect of observation skill. This result was in contradiction with the study of Pandey and Sthapak (2021) who found that the type of school doesn't play an important role in the attainment of SPS. It was not surprising for the investigator that both systems of schools are not equal in developing the SPS. The input of both types of schools is far different from each other. The private school system gives more opportunities to their students to explore their SPS. They involved their students in activity-based learning whereas despite better facilities public school system was not able to develop SPS among their students.

In the aspect of relationship skills, the private school system again performed better than the public school system however the performance of both systems lies in the category of good performance. It might be due to the reason that the student's conceptual understanding was better about the relationship of different variables. Overall, student's performance was found to be fair in the aspects of communication and measurement skills. This result is in tune with Irwanto et al. (2018) have reported the students' measurement and communication skill level of performance at a medium level. Irwanto et al. (2018) also reported that students' performance was better in the aspect of measurement skill as compare to communication skill. Same result was also reported by Andini et al. (2018), he also found that students achieved the lowest percentage score in terms of communication skills. In this study, it was observed that students were unable to explain the data in their writing or orally, obtained during the experiment.

It was also found that students merely have an idea to represent data graphically. They

were unable to describe the procedure of the experiment. Students were not able to share their observations properly. They were unable to use words, graphics or symbols to describe the observation and results of the experiment.

The low communication skill can be caused due to low ability in mastering the scientific language, the lack of interaction between teacher and students, low interaction among students or incompetency in drawing and constructing the graph. One reason behind the low communication level was the effect of not involving students in scientific activities which provides an opportunity to write or speak about different events of scientific investigation. To optimize the communication level of students, they could be motivated to implement the scientific process in their daily communication. Proper training of teachers and students could also be effective for the improvement of communication skills. In the aspect of communication skills both public and private school students' performance was equal but for measurement skills, private school students performed better as compared to public school students. Overall basic science process skills' level of performance of students was found to be good .This is coherent with the result of the study conducted by Derilo (2019). Derilo (2019) found that students have an average level of basic science process skills. Irwanto et al. (2018) also reported that students' average basic science process skill level was at a medium level.

In some indicators of basic science process skills, the fair performance of students may be attributed to less weightage to practical work in Pakistan. Most science teachers give more emphasis to theory and they did not involve in lab work. Secondly, the curriculum is not designed on such a pattern which allows students to develop such aspects of science process skills. Another reason for fair performance of students was our practical exam system. Most questions in the exam were based on observation and calculation .So teachers used to complete practical work for the sake of exams and not for sake of developing science process skills in students. Such learning activities which guided students to communicate a scientific concept effectively were not used during science teaching. In both public and private school systems, science teachers did not arrange such instructional activities which give students an opportunity for group discussion .Students of both public and private school systems were unable to deliver scientific knowledge textually as well as verbally.

CONCLUSION

From the result of the study, it was concluded that private school students' skill level of performance was high, in all aspects of basic process skills except communication skills, as compared to public school students. In this research study, the researcher tried to answer the question "Is there any difference in basic science process skills of public and private school students? "In the light of above mentioned findings, it was concluded that there was a statistically significant difference exist between public and private school Physics students' performance in observation skill, measurement skill, relationship skill however there was no statistically significant difference exist between public and private school Physics students' performance in communication skill. Null hypotheses of the study stating that there is no statistically significant difference between public and private school Physics students' performance in basic science process skill were completely rejected. Private school student's performance was fair in communication skills whereas public school students' performance was fair in communication and measurement skills, which indicates that more attention to be paid to improve these aspects of basic science process skills. The research study has a significant impact and implications in the field because it has identified weak areas of students in basic science process skills. Based on this research administration of the city of Rawalpindi as well as the administration of Punjab (province of Pakistan) may change their strategies to improve weak areas of SPS like communication and measurement skill of students. Moreover public and private sector comparison showed that more work has to be done to develop basic science process skills in public sector students and it may be helpful if we sensitized the public sector teacher in the context of basic science process skills. In light of this study following recommendations are made. (1) Teachers should not only rely on books for Physics teaching. They must involve students in the experimental process by conducting experiments in a laboratory; (2) Despite better facilities Public school students' science process skills were found to be low compared to private school students therefore it is very important to carry out new studies to explore the reasons for poor performances; (3) Teachers should give more attention in developing measurement and communication skills so that their reasoning, evaluating, problem-solving and creativity ability enhance; (4) Teachers of both public and private schools must not only focus

on making observations. They must give more attention to the analysis of observation so that students will be able to interpret data properly and communicate results properly; (5) Teachers must be sensitized related to science process skills so that they can pay more attention in this domain; (6) School administrators of both public and private schools need to develop a training program for teachers to enhance their capability of activity-based teaching so that they would foster the development of SPS.

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