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## **Teachers' Practices in Blended Learning Environment: Perception of Students at Secondary Education Level**

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### **Abstract**

*The overload in teachers' role has been renowned and optimized by generative adaptation of technology, which means teaching capability can be improved if educationalists blend technology tropically and timely. Based on this belief, this study tried to judge the teachers' practices in Blended Learning (BL) environment in the context of secondary level students. For this purpose, an empirical study was conducted at Government High School No.1 (boys) Tordher district Swabi Khyber Pakhtun Khwa (KPK). All 120 enrolled science students of grade 9 and 4 science teachers participated in the study. The students' perception of teachers' practices of preparedness, innovation, and developing feedback skills in the BL environment were ascertained through a survey questionnaire whereas 20 students were also interviewed randomly. The responses were measured through a 5-point based*

*Likert scale, data were analyzed through descriptive statistics. The research method used for this study was the explanatory sequential approach of mixed-method (Creswell, 2014). Based on the study findings, teachers' practices improved in the BL environment and hence recommended that secondary school teachers need to be encouraged to use the BL approach instead of merely using Information Communication Technology (ICT) or traditional methods of teaching.*

**Keywords:** BL emergence, BL utilities, e-learning vs BL, teachers' BL savvy, using educational technology

### **Introduction**

Third world countries, including Pakistan, are facing main challenges in the use of e-learning such as electricity outages, computer illiteracy, and the inability of using technological devices, and internet access. As a result, integration of ICT in the education system of the country is affected (Barbour et al., 2011). The lack of staff and basic infrastructure in most of the rural, even in urban schools of the public sector, evidenced that education had not been prioritized in the government policies. These confronting situations provided space for, in the local milieu, researchers to conduct studies aiming at either on the integration of ICT in the education system (Hameed, 2007; Memon, 2007) or evaluating suitability and accessibility or availability of basic infrastructure for ICT integration at higher education (Koo, 2008). In the same light, the author of this research study aimed to examine whether BL heightens the perseverance and self-reliance of teachers and students (Kuh et al., 2006) at the secondary level, as this stage serves as a gateway for further education. McCue (2014) found that BL had developed analytical and evaluative skills of teachers by exploring the relevant contents of the lesson.

### **Pakistan's Initiatives towards BL**

The use of ICT is still at the emergence stage in developing countries due to limited resources (Barbour et al., 2011). In the same light, the Higher Education Commission (HEC) of Pakistan did its best to digitalize the education system to level up its educational quality to the international standard of education (Rahman, 2006). Sooner, to meet these challenges, the government of Pakistan concentrated (Kundi, et al., 2010) on the issues, and especially, KPK provincial government very recently made efforts to resolve these issues in the education system. It paid special

attention to the appointment of Information and Technology (IT) staff. They established IT laboratories in 339 secondary schools of KPK province in the fiscal year 2013-14 (Government of KPK, 2017). In the same vein, 1000 more schools were equipped with IT labs in the year 2015-2017. Altogether 1100 interactive whiteboard smart screens had been installed in the schools of 14 districts out of 26, along with the installation of a solar panel to resolve issues of electricity outages. Similarly, 600 schools, in the whole province, were considered to be provided with the smart screens for benefitting 8500 classrooms from technology. It was thought that the whole curricula should be taught through these smart screens. For this purpose, The Directorate of Curriculum and Teacher Education (DCTE) was assigned the responsibility to digitalize the curriculum for replacing the old traditional blackboard system with a smart screen (Education Department Khyber Pakhtunkwa, 2017). That was the reason that DCTE launched an intensive BL introductory program to familiarize the primary school teachers of KPK with using ICT in Education (Ameen, 2018).

Now the question arises, how much are these efforts fruitful on behalf of the provincial government of KPK in favor of public sector secondary schools' teachers of the province. Contrasting views on using blended learning in teaching practices have created more questions than answers. Therefore, it was determined to investigate if there is indeed a link between blended learning instruction and secondary school teachers' practices. It is believed that the ongoing research study will work as a supplement in the area of secondary school teachers' education.

### **The Study Context**

This paper sketches on the data assembled for a Ph.D. project, which studied the impact of blended learning on teaching and learning of physics: perception of teachers and students at secondary level education. The field data for the project was collected from 120 science students of grade 9 and 4 science teachers from a public sector high school locates in city Tordher of district Swabi KPK, Pakistan. Mainly four research questions and objectives were composed for that particular research project.

The study draws on (i) post-survey questionnaire, for knowing the participants' computer literacy and hence the deficiencies were covered during the training session, (ii) survey questionnaire data from teachers and students, (iii)

random interviews data from teachers and students, (iv) and the author's classroom observations. The survey questionnaire data was validated by triangulating the latter two collected which in the opinion of Creswell (2014) is a sequential embedded technique of mixed-method research. The justification for selecting a particular public sector high school Tordher located in KPK is that, currently, KPK is the foremost province of Pakistan that spent a huge amount on the installation of the latest ICT equipment and computer laboratories in public sector secondary schools. It was considered that these resources can be utilized through BL gainfully. This sampled data results for other ICT equipped secondary schools in the country to use blended learning in their daily teaching and learning activities. The strength of enrolled 9th-grade science students and science teachers in the sample school, at the time of conducting the study, was 120 and 4 respectively. The rationale behind including all these students and teachers as participants of the study was to get enough and reliable data for this research study. The justification for including all four teachers in the study was teaching 4 groups of students separately whereas each group contained 30 students. The purpose behind the selection of grade 9 students was their enough number to participate in the study as compared to grade 10 that were contained 80 students at the time of this study. However, agreed on the capacity of this research study, the teachers' practices in BL environment is the only focal point of this research paper so is anchored on the question: What are students' perception of teachers' practices and behavior in a blended learning environment?

This research question is further split into the following three questions for elaborating the study results more precisely.

- 1) What is students' perception of teachers' preparedness in BL?
- 2) How do students' perceive innovation in teachers' teaching skills by using BL?
- 3) What is students' perception of teachers' feedback in the BL environment?

## **Literature Review**

### **Concept of BL**

The term e-learning was introduced in the 1980s (Bersin, 2004) when online and distance learning bubbled up. Distance learning or online learning offers

opportunities to access education to those who cannot attend school. However, the term e-learning is broader than distance learning (Moore et al., 2010). That is why the use of e-learning in the traditional classroom environment has been more productive as compared to using mere e-learning. E-learning aids practitioners or learners to access the relevant course content more conveniently even away from school. At the same time, face-to-face interaction in a traditional classroom setting provides the learner's opportunities for strengthening messages and interacting personally with their teacher or peers. Many researchers (Doom, 2016; Gottlieb, 2015; Hui, 2016; Lam, 2015; Larsen, 2012) executed e-learning in a face-to-face classroom environment successfully and proved that these two modes together had generated such an educational environment where educators and learners had frequent access, disclosure to all sort of educational matters, and improved their teaching and learning skill. This approach of learning emerged the concept of Blended Learning.

### **Utilities of BL at Secondary Education Level**

The mix of internet technology into education has been an important development since 2000 (Picciano, 2014). It is no more a mere source of distance learning rather it is used as a source of education at all levels in American Schools. They developed the curriculum by mixing of internet and traditional pedagogies, which helped their students in the completion of academic courses (Hui, 2016). Graham et al. (2013) investigated that on-line learning behaved as enforcement for routine teaching and learning.

The previous research studies indicated the use of the BL approach successfully in high school education of the developed countries (Hill, 2015), persuaded the developing countries to use technology at this level. This scenario, by considering the teacher as a decisive role player, demands from teachers' educators to appraise and modify their instructional programs for renovating the teachers' skills to meet these challenges. Resultantly, teachers would need to increase their effort to improve their acute abilities to keep up with the learners and become familiar with restructured education by adopting the technology-based techniques of education. This distinguishes the 21st-century teachers from those who were qualified in the 20th century. In this connection, studies that are more empirical were recommended (Means et al., 2013) to be carried out for enhancing

the teaching experiences of those teachers who were less experienced or had less knowledge of using the BL approach in their teaching practices. There are five major reasons (Picciano et al., 2012) that are needed to be considered for offering BL courses in secondary schools by the administrators. These are: (i) When the courses are not offered; (ii) When the courses are satisfying the requirements of a specified group of students; (iii) When the courses are offered for the higher level; (iv) If the course enables the students to take the taught courses again and again for improvement purposes, and (v) If the courses offered are reducing the clashes in schedules of students.

Staker (2011) found that use of BL emerges in education due to low budgets for education, increasing teachers' shortage capacity, the legislation acts such as 'No child left behind', students' proficiency in main subjects, students' retaining, and tutoring of students at school as well as at home. The other forces behind the use of technology in education are the demand of raising students' achievement, having a short time to teach inside the classroom, increase of students (Gagnon, 2014) through permitting open enrollment throughout the year (McAlister, 2013); and high dropout rates of students (Ellis et al., 2006). In this intimidating situation, BL courses have the potential to meet these kinds of challenges efficiently, improve the performance of students and increase their understanding through engaging them in various learning activities (Lam, 2015). The researchers (Hui, 2016) believe that BL generates intrinsic motivation in learners, which means that it instigates cognitive function in a person for gaining a quality learning experience.

The detachment between teaching practices and learning activities is the challenge (Nwachukwu, 2015) for teacher educators. The new pedagogy of BL breeds a much appropriate atmosphere for schooling. The integration of technology in the on-line format of BL not only improves the quality of teaching (Poon, 2013) but also makes it possible for students and their teachers to work together (Staker & Horn, 2012). BL provides an edge to schools for embracing the contemporary wants of the modern-era by using the innovated research-based educational technologies designed for the occurrence of the effective educational process.

### **Teachers' Savvy of Using BL**

The argument in demand for secondary education level blended learning

fetches with it the corresponding need of teachers enabling them to teach efficiently in this promising context. The recent discussion of researchers Archambault et al. (2014) has disclosed the importance of inculcating blended teaching into pre-service experiences of student-teacher. In addition, being frequently submerged in the atmosphere, where knowledge searching and social interaction is comprehensively based upon technology; the students of today felt the need to blending technology in learning lessons (Chew & Wee, 2015). This notion has directed teachers to integrate information technology into their teaching practices to make their pedagogies more effective (Starkey, 2010). However, Bakerley (2010) suggested supplementary research to find out the capabilities for improving the teachers' effectiveness. In the same direction, Yapici (2012) found the application of BL instruction significantly positive.

The appropriate application of BL enhances teaching and learning capacity (Gottlieb, 2015; Lam, 2015). However, it should not be understood that technology can replace the teachers rather it is used as a major tool for innovating the teaching pedagogies and saving time and labor (Doom, 2016). Pedagogically and technically the teacher's role is important for teaching any course content and is frequently justified for BL successfully (Dziuban et al., 2006; Hoffman, 2006; Kaleta et al., 2007). BL lends a hand in the retention of students because of efficient interaction between students and teachers (Gomes, 2014), maintaining the interest of the students through an assortment of accessible technical resources, integrating various modalities for contents delivery. BL also assists in assessing to customize individualized assignments (Hudson, 2013). The use of the BL approach is very challenging for those teachers (Nwachukwu, 2015) who are still following traditional and teacher-centered lessons.

Technology does not restrict teachers to abandon the old pedagogy, rather allowing them to use technology for the rich learning experiences of the students (Shahid, 2017). Teachers can create a BL environment by employing various online instructional models in the f2f classroom environment (Staker & Horn., 2012) and as well as away from the school such as the 'flipped technique' (face-to-face interaction alongside online activities). This type of interactive environment does not support only teaching but also scaffold the learning skill (Hui, 2016). The liveness and handiness of BL provide the teachers an opportunity for developing different paths of interactive and collaborative learning even by using a single

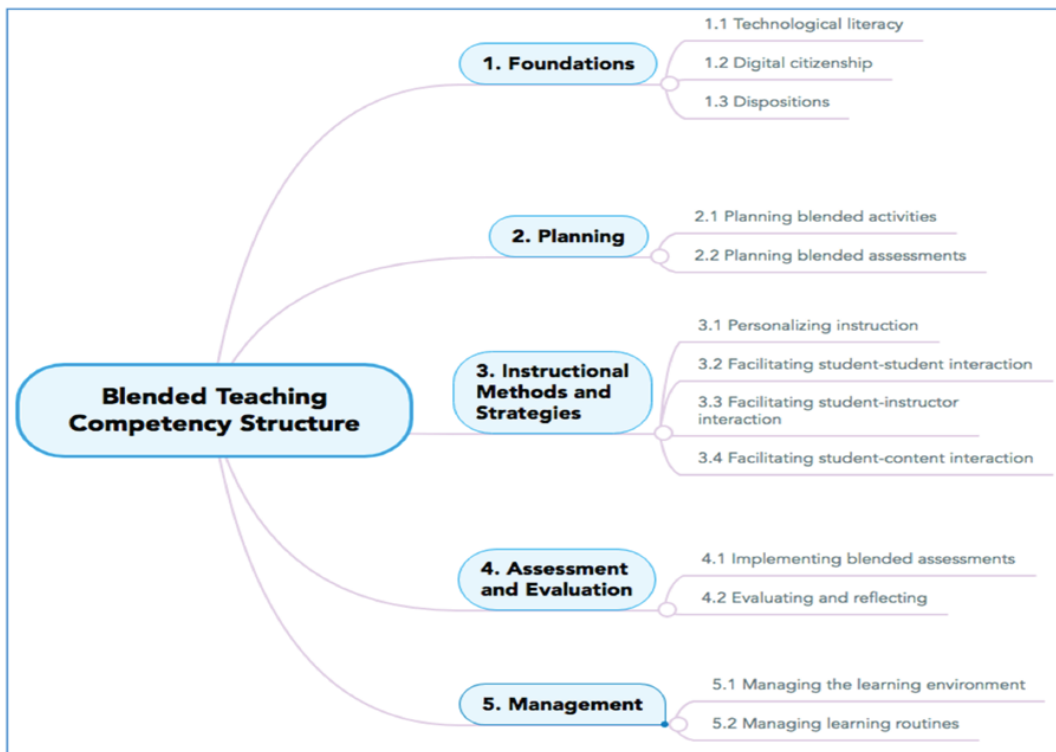
iPad/tablet/white interacting board/computer for all students (Kristin, 2014). Here, it is notable that the availability of technology to use does not necessarily mean to integrate into teaching (Dwyer, 2016).

### Teachers' Readiness for BL

To get ready to work in a blended learning environment, a compiled research-based substantiation of effectual blended learning practices highlighted that the teachers, using blended learning approach, need to consider (a) class context, (b) pedagogical strategies, and (c) technology (Oliver et al., 2014).

### Figure 1

*Oliver's Blended Profile competency Structure (Oliver, 2014).*



Before online and blended teaching, the focus of technology educational training was the integration of technology, concerning incorporating technology in classroom instruction (Graham et al., 2017). These researchers explained the table



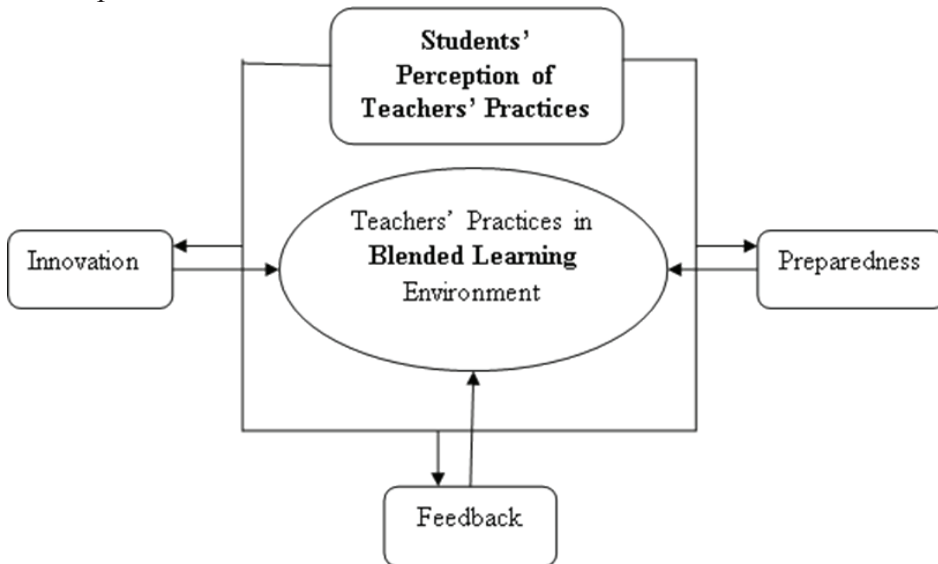
shows that traditional mode contained skills emphasizing students' engagement with digital content; online teaching involves a physical severance amongst teachers and students, comprising of communication skills and its engagement with both digital and non-digital contents. The combination of the traditional model and online model skills constructs a blended teaching model.

### Conceptual Framework of the Study

The following (Figure 2) conceptual framework of this study displays the design of teachers' practices in BL environment: perception of students at secondary education level concluding teachers' preparedness in BL environment, innovation in teachers' practices, and the trend of teachers' feedback on students' work. Teachers' practices in the BL environment is treated as a dependent variable whereas students' perception regarding teachers' preparedness, innovation, and feedbacks in the BL environment as independent variables.

**Figure 2**

*The Conceptual Framework*



The diagrammatic view shows that the dependent variable is fixed in the middle while independent variables evidence the effect on the dependent variable with pointing arrows.

## Methodology

The research paradigm was an explanatory sequential approach of mixed-method (Creswell, 2014) following a concurrent embedded approach for data collection of this experimental study. The study was conducted at Government High School No. 1 Tordher district Swabi of KPK where 120 students were enrolled in a science group of grade 9 and were taught by four science teachers in four separate groups using a blended learning approach. The students' perceptions about teachers' practices in the BL environment were found through a survey questionnaire (Larsen, 2012) and a short semi-structured interview. The questionnaire responses were measured through a five-point Likert scale: 1. Never 2. Seldom 3. Sometimes 4. Often 5. Always, which led the researcher to use mean and standard deviation as analytical tools for presenting the data. The interview data were analyzed and decoded through a general inductive approach (Thomas, 2006) to obtain results for cross-validation of quantitative data results. The procedure of group formation and interviews was as under:

**Table 1**

*Formation of Groups for the Study*

Group	Teacher Code	Class	Teacher skill in BL	Students per Group	Interview Students per Group (Selected Randomly)
A	T-A	9 <sup>th</sup>	Trained	30	5
B	T-B	9 <sup>th</sup>	Trained	30	5
C	T-C	9 <sup>th</sup>	Trained	30	5
D	T-D	9 <sup>th</sup>	Trained	30	5
Total	4			120	20

## Contents and Procedure of Teaching in BL Environment

Four BL trained teachers taught two chapters of 9-grade physics through the web page 'Sabaq Foundation KPK' (<http://www.sabaq.pk/video-page.php?sid=kpk-physics-9th-8.3&v=p-9-10-ther-pr-op-10>). The activities consisted of theoretical and practical work. The duration of the course was 12 weeks (4/7 days) containing 40 minutes period a day. The classroom activities contained a review section, on hand, and new content as well as application material. The internet sites, online video clips of lectures, and

demonstration of practical activities were performed on White Interaction Board in the computer lab. The website ‘Sabaq Foundation’, a course developed by KPK Intermediate and Secondary Education Boards for class 9, was used for this purpose. Apart from that, Emails, WhatsApp, and imo accounts were used for course contents distribution and for interacting each other while working at home.

**Table 2**

*The Module of Contents teaching in BL Environment*

Duration	Chapter 1	Duration	Chapter 2
	<i>Thermal Properties of Matter</i>		<i>Properties of Heat</i>
Week1	Content of Temperature, Heat,	Week7	Conduction of Heat
Week2	Thermal Expansion of Solids	Week8	Thermal Conductivity
Week3	Practical work on the taught content	Week9	Practical work of the content taught
Week4	Thermal Expansion of	Week10	Convection of Heat,
Week5	Liquids, Heat Capacity, and Specific Heat Capacity	Week11	Radiation of Heat
Week6	Practical work of the taught content	Week12	Practical work of the taught content
6 weeks		6 weeks	= 12 weeks

## Findings

### Students’ Perception of Teachers’ Practices

Students rated the means of all items (Table 1) well above 4 on a 5-points Likert scale, meaning most of the students have a positive perception of teachers’ practices.

**Table 3**

*Students' Perception of Teachers' Preparedness, Teaching Skills, and Feedbacks in BL*

S.N	Items	N	Mean	SD
1	Teacher was prepared to respond to my queries	120	4.94	0.29
2	Teacher concentrated on the work of students in the classroom period	120	4.89	0.33
3	The teacher kept a good balance in on-line and classroom activities	120	4.22	0.46
4	The on-line, classroom and lab activities were blended well	120	4.57	0.87
5	Teacher supported students' work in a group and helping each other	120	4.85	0.42
6	The teacher persuaded students to use various methods for learning	120	4.84	0.40
7	The teacher welcomed students working on their own	120	4.81	0.52
8	The teacher appreciated my way of learning	120	4.81	0.52

### Students' Interviews

Students were indirectly inquired to ascertain their views in respect of teachers' preparedness, innovation in teaching skill, and teachers' feedback on the work of students. Because students pass the critical remarks very rarely about their teachers, due to cultural, religious, and social constraints in the Pakistani context. Below, Table 2 contains the main questions that were asked during interviews.

**Table 4**

*Students' Interview Questions Interview Questions*

S. No	Questions
1	How did you find your teacher's teaching in the BL
2	environment?
3	Did your teacher support you in BL, how? How did your teacher treat you when you were using BL?

The data presentation was framed according to the research questions as following.

### Teachers' Preparedness

When students were asked, "how did you find your teacher's teaching in BL environment?" Most students stated that the teachers were prepared well, attentive towards students, and directed them to use BL in their studies. For instance, a student remarked about T-C:

*“I needed help to integrate my course content, online activities, and to demonstrate practically, I asked for help and my teacher provided me promptly.”*

Similarly, another student commented about T-A:

*“I liked the way my teacher explained the content inside the classroom, showed us online videos of the content in the computer lab, and demonstrated practically inside the science lab.”*

Students’ comments explain reasons that why did items 1, 2, 3, and 4 (table 1) receive a mean rating above 4 on a five-point scale, confirming good preparation of teachers to teach in the BL environment.

### **Innovation in Teachers’ Teaching Skill**

Mostly, it was discovered during interviews that teachers taught their students in various ways such as taught individually and in groups inside the classroom, in the computer lab and science lab. When the students were asked about their teachers’ behavior during teaching; they generally liked and appreciated the change they felt in teachers’ approach and behavior towards their learning activities. For example, four students appreciated the cooperation of T-B in online activities, his persuasion to keep in touch for group on-line discussions, and exchanging their views to solve a problem. Similarly, the other 11 respondents from different groups expressed their views that teachers were very friendly inside as well as outside the classroom and devoted time to answer their course-related queries. Likewise, a student of group D expressed his views:

*“My teacher paid attention to each student individually and appreciated the work of each individual. He responded to our questions promptly and in detail”*

Students’ comments gave the impression that they had liked the change in the teaching approach of their teachers. These comments of students explain the reasons for high mean ratings of items 5, 6, and 7 respectively, showing that teachers’ teaching skills improved by using the BL approach.

## Teachers' Feedbacks Development

Most students commented positively on receiving feedbacks from their respective teachers. For example, three students stated that teacher T-D provided them feedbacks on the spot on the evaluation of each other's work. Another student appreciated teacher T-C:

*"Our teacher gave us feedback about learning our course work as a result, our mistakes were pointed out and we sorted them out immediately."*

Similarly, an interviewee commented about teacher T-B:

*"The continuous feedback from my teacher enabled me to learn from my mistakes. So I think feedbacks are very important for improving our learning skill"*

Students' comments confirmed the high mean rating of item 8 ( $M=4.86$ ), revealing positive feedbacks of teachers on students' work.

## Discussion

Previously, section 4 presented the results ascertained from quantitative and qualitative data collected through students' responses regarding students' perceptions of teachers' practices in the BL environment. The overall expression of students was positive and perceived that teachers were consistent with good practices in the BL environment. These results supports the statements of (Hoffman, 2006; Kaleta et al., 2007; Larson, 2012). More detailed results of this research study are discussed in the following sub-sections.

### Teachers' Preparedness in BL

The results indicated that teachers were well prepared ( $M=4.94$ ,  $SD=.29$ ); and were able to respond to the students' queries promptly in terms of performing online, classroom, computer, and science lab activities. Moreover, teachers were keenly focused on students' work during classroom activities ( $M=4.89$ ,  $SD=.33$ ). Teachers were good and capable enough in both teaching online and inside the classroom as the two formats were well-balanced ( $M=4.22$ ,  $SD=.46$ ). That is why the two formats, On-line, and classroom, alongside the lab activities worked well

together ( $M=4.57$ ,  $SD=.87$ ). Students appreciated the way their teachers put the content in plain words in the classroom, used the computer lab for showing the related online videos, demonstrating the content experimentally inside the science lab. The findings indicated that teachers improved their teaching skills by blending both online and classroom activities which are the two compulsory factors (Horn & Staker., 2014) of a successful BL environment.

### **Innovation in Teaching Skill**

The results indicated that teachers supported students to help each other in groups ( $M=4.94$ ,  $SD=.29$ ) at the time of need. Teachers motivated students by persuading them to learn in various ways ( $M=4.84$   $D=.40$ ) such as performing online activities along with the classroom and science lab activities. The designed and prearranged resources of hyperlinks and webby teachers enabled the learners to gain a better understanding of content. The approach of using various resources which helps in scaffolding and constructing new knowledge at various stage of the learning process such as students get ready in advance with pre-assigned online work before attending by watching the videos of practical experiments of physics before the teacher's demonstration inside the classroom (Hui, 2016) helped in better grasping of concepts by the students. Similarly, learners can download many videos related to the content before the teacher's demonstration in a traditional classroom environment.

They also encouraged the students' way of learning ( $M=4.81$ ,  $SD=.52$ ). Students liked, expressed joyfulness, and showed their satisfaction with this act of teachers. These internal desires of joyfulness indicate that students got the intrinsic motivation, a cognitive function, which inspires the learners to achieve eminence learning skills (Hui, 2016); and reduces students' dropout rate from school (Ellis, 2006). The results of students' interviews affirm that BL innovated teachers' teaching practices. Likewise, most of the students discovered that their teachers taught them using various methods, teachers not only used the classroom and science lab but also used the school's computer laboratory for watching videos and studying other relevant content. Through this pedagogy, the teacher brings creativity in students through the creation of knowledge by a pragmatic way which instills motivation among students (Piaget, 1989) and resultantly they become involved in the development of cognitive constructivism (creating new meanings from past and current learning experiences).

### **Teachers' Feedback**

Students perceived positively that their teachers gave feedback on the spot on students' work ( $M=4.86$ ,  $SD=.39$ ). In this connection, the students interviewed revealed their teachers passed positive comments if they had done a mistake during studies in the BL environment and received answers to the questions in a friendly environment even when asked questions after the class time was finished. Teachers paid attention to each student's participation in the BL course and appreciated their work verbally. This feedback helped the students to correct their mistakes promptly. These findings revealed a strong relation of interaction between the students and teachers in terms of teachers' capability of providing feedbacks (Roschelle et al., 2000), which is a skill of utmost importance for improving the learning capability of students. In other words, BL enabled the teachers to adopt the habit of interaction and giving feedback on students' work.

### **Limitations of this Study**

The results of this study have likely been influenced by various ways such as:

1. There are possibilities that teachers amend their outlooks, positively or negatively, about using BL due to experiencing feeble control on classroom activities, lack of interaction with students because of restricted class periods.
2. The other limitation that may have influenced the significance of this study is the small sample size, which possibly may have influenced the statistical measurements. However, this issue of small sample size is acceptable (Larsen, 2012) because it is unlikely to be improved soon.
3. Due care needs to be taken in generalizing the results of this study because a small sample size is considered to restrain a wider variation of the results (Strauss & Corbin, 1998). However, researchers like Crouch and McKenzie, (2006) argued that a small sample was desirable because "this is the way analytical, inductive, and exploratory studies are best done". However, a long-term research study with large sample size can likely give more reliable results and further shed light on the sustainability of using blended learning.

### **Conclusion and Recommendations**

It is concluded from the results of both the sources that BL had improved teachers' practices and experiences. The two important factors, online and



classroom activities of BL (Horn & Staker, 2014) were used quite productively during a teaching in the BL environment. Hence teachers were well-prepared to use the BL approach in their teaching. Students felt an innovation in teachers' teaching practices in the BL environment such as teaching by clubbing three different ways (Chandra & Fisher, 2009) online, classroom, and practical demonstration. It is also concluded that the BL course generated a strong relation of interaction and feedbacks between the students and teachers (Roschelle, et al., 2000). Based on these conclusions it is suggested for the experts of curriculum development, educators of teacher education, and for the educational policymaker to include BL courses in the programs developed for training teachers especially, at the secondary level. These training courses need to contain various online and classroom activities. It is also suggested that BL training courses are not necessarily to be restricted to science subject teachers, rather be developed for all those teachers who teach at the secondary level.

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