

# Blended Learning Implementation at Ahsanullah University of Science and Technology – an Academic Quality Enhancer and a Savior During the Covid-19 Pandemic

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## Abstract

This work evaluates blended learning implementation at Ahsanullah University of Science and Technology (AUST) by integrating technologies with the collaboration of the Commonwealth of Learning (COL). It explores the readiness of students toward blended learning through their attitudes, perceptions of, and satisfaction. The Technology-Enabled Learning policy is institutionalized based on the necessary infrastructure and capacity of AUST and Twenty blended courses were developed for the students. These blended courses were offered by AUST during the COVID-19 pandemic, from 2 February to 13 December 2020. A student survey was carried out in all these courses. Twenty instructors also participated in a different survey comprising a few very significant questions addressing the experience of the teachers in terms of designing and teaching blended courses. After a successful application of blended learning at the AUST premise, we have gathered, filtered, and performed a number of significant statistical analyses on the available data to assess the impact. Course-wise performances for blended courses over non-blended ones were calculated. A stepwise regression analysis was performed to see the impact of the students' self-regulated learning behavior. The approach came in handy to partially tackle the COVID-19 pandemic, which forced a nationwide shutdown of face-to-face studies in Bangladesh.

**Keywords:** Technology Enabled Learning, Blended Learning, Learning Management System, Ahsanullah University of Science and Technology

## 1. INTRODUCTION

Technology-Enabled Learning (TEL) means the use of some form of digital technology to support teaching and learning. Blended Learning (BL), a variant of TEL, is a combination of face-to-face instruction and online learning. This method of learning enables both teachers and students to engage in ways that would not normally be available in a traditional face-to-face classroom style. Here, students attend a class taught by a teacher in a traditional classroom setting, while also independently completing online components of the course outside of the classroom. The online and in-person learning experiences would go in parallel and complement one another. Moreover, the resources will be available for them to access anywhere and anytime.

AUST has been collaborating with the Commonwealth of Learning (COL) since 2019, and a baseline study on TEL at AUST is already available (Kalpoma et al., 2019). Using a systematic approach, a TEL policy was developed and several capacity-building activities on TEL were also organized. An outcome of Phase 1 was clarity on the institution's

TEL infrastructure and capacity. This study is part of Phase 2 activities to institutionalize the TEL policy by developing some blended courses and offering these to students. COL's *Guide to Blended Learning* (Cleveland-Innes & Wilton, 2018) assisted with the development of these courses, and various templates in the guide were used to assure the quality of the developed courses. By the end of Phase 2, a group of teachers had become experienced in developing and delivering BL courses, which aimed to improve student learning experiences and outcomes by providing them with flexible and interactive learning opportunities. This phase also focused on evaluating TEL implementation by measuring student learning outcomes in concurrent blended courses.

## 2. OBJECTIVES

The specific objectives of this study are to answer the following six questions to assess the impact of a Blended Learning (BL) environment in teaching and learning:

- Finding significant differences in performance between students in blended and non-blended courses.
- Comparing students' performance versus achievement levels
- Finding the significant relationship
  - between learners' perceptions, motivation, digital literacy, attitude towards learning, and final score in a blended course.
  - between self-regulated learning behavior and students' learning performance
- Analysis of learners' personal opinions on the effectiveness of the BL environment for their course of study.
- Impact of the training and mentoring program on the teachers' experience of designing and teaching in a BL environment.

## 3. METHODOLOGY

The study focuses on gender-based and cross-disciplinary variations in learners' attitudes, motivations, and barriers to the blended courses of TEL. This study considered the data of a total of 2220 students who were enrolled in the eighteen courses offered from February to December 2020 in a blended learning form at the Moodle LMS of AUST. A few students were enrolled in multiple blended courses, which aggregated together resulted in a total of 2682 sample-sized students. The survey questions were developed by COL in previous studies (Bhagat, 2019) to assess the impact of blended learning among the students. A total of 76 closed questions and one open-ended one were presented to the students for the purpose. A total of 309 survey responders with a male-female ratio of 69:31 and aged between 18 to 24 have voluntarily participated in the assessment survey. The same eighteen courses had been offered in the previous semester in a non-blended mode. We have compared the impact of blended teaching and learning methods in terms of grades obtained with the non-blended mode.

We also categorized the students who participated in the blended mode into three different achiever groups such as high achiever (pre-CGPA of 3.081– 4.00), average achiever (2.648–3.078), and low achiever (2.00–2.647). The students in the non-blended teaching and learning mode were also categorized into similar groups. The CGPA ranges for the achiever groups were selected based on a fair distribution of students, with similar numbers of students in each category. The BL and non- BL results of these groups were compared to assess the impact.

We sifted through around half a million student records extracted from the Moodle LMS at AUST. This mammoth amount of information was divided into various categories, including students' course view, file access, forum access and a student's total number of logins to the system during the course study period. These numbers were progressively matched with the students' earned CGPA in the BL courses to assess whether the students' self-regulatory learning behaviors had any impact on their performance in the courses. A total of 20 teachers of the BL courses also participated in a detailed interview using questions modified from a study by Mishra (2017).

We have used Microsoft Excel, IBM's SPSS software, and a Custom-built application using PHP and MySQL for the data analysis.

#### 4. FINDINGS AND ANALYSES

Initially, the survey was recorded on a five-point Likert scale and was collapsed into three categories such as *agree*, *neutral*, and *disagree*. A likelihood ratio chi-squared test was employed which compares the participants' actual responses to the questions during the survey and assesses the statistical significance of the responses. Figure 4.1(a) shows the likelihood ratio along with survey responses and figure 4.1(b) shows the combined results of survey responses. A higher chi-square value usually points towards a greater difference.

In the survey (Figure 4.1(a)), a higher proportion of respondents agreed (54%) than disagreed (28%), with a moderate number of participants (18%) remaining neutral as shown in Figure 4.1 (b). With respect to the “attitudes towards thinking and learning” scale (Hoque et. al, 2021), the overall score showed a significantly higher proportion of participants agreed (65%) than disagreed (7%), but a substantial portion of students (28.4%) preferred to stay neutral. Similarly, other groups of questions (Hoque et. al, 2021) had a significantly higher proportion of respondents agreeing than disagreeing, with a handful staying neutral. The p-values for all the categories were below 0.001, indicating a strong and significant difference in participants' opinions regarding their experience of and interest in the BL courses.

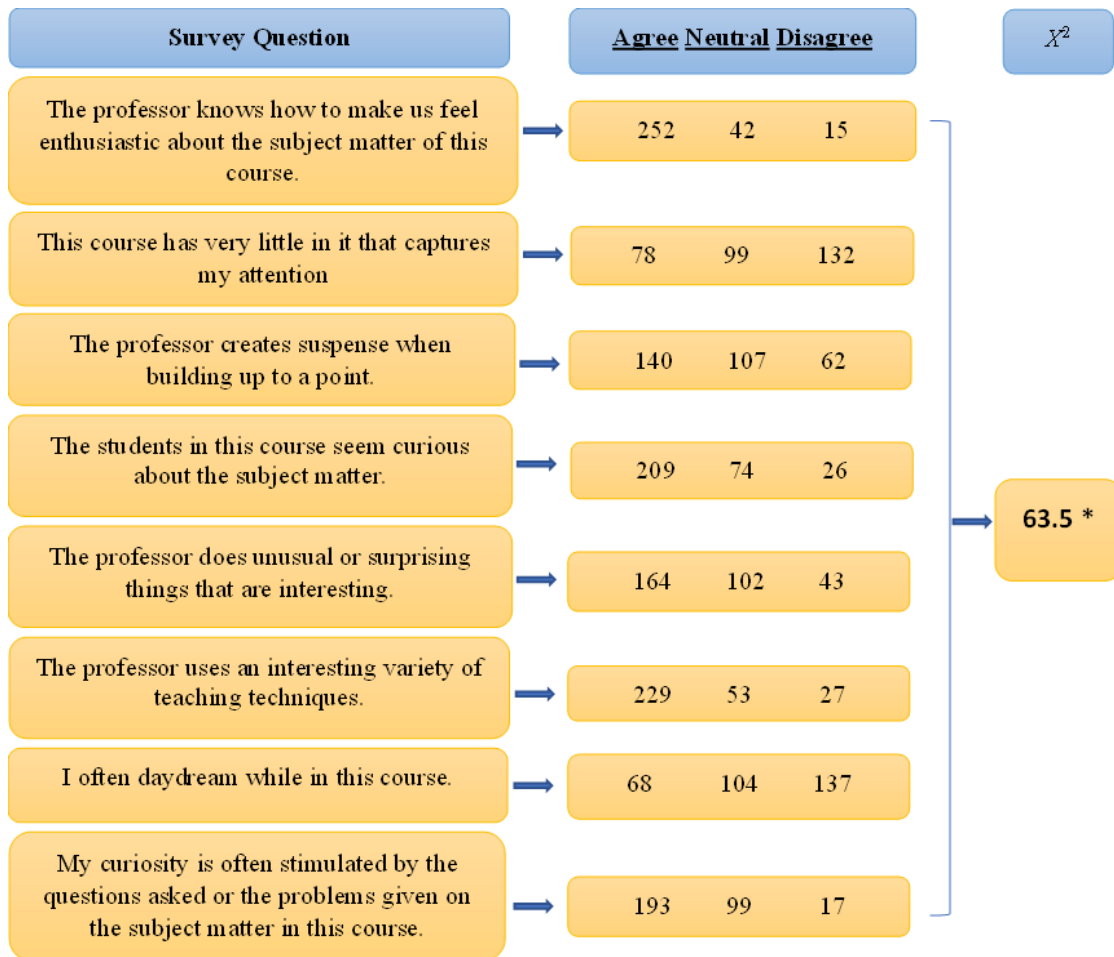


Figure 4.1(a) Survey responses and the likelihood ratio.

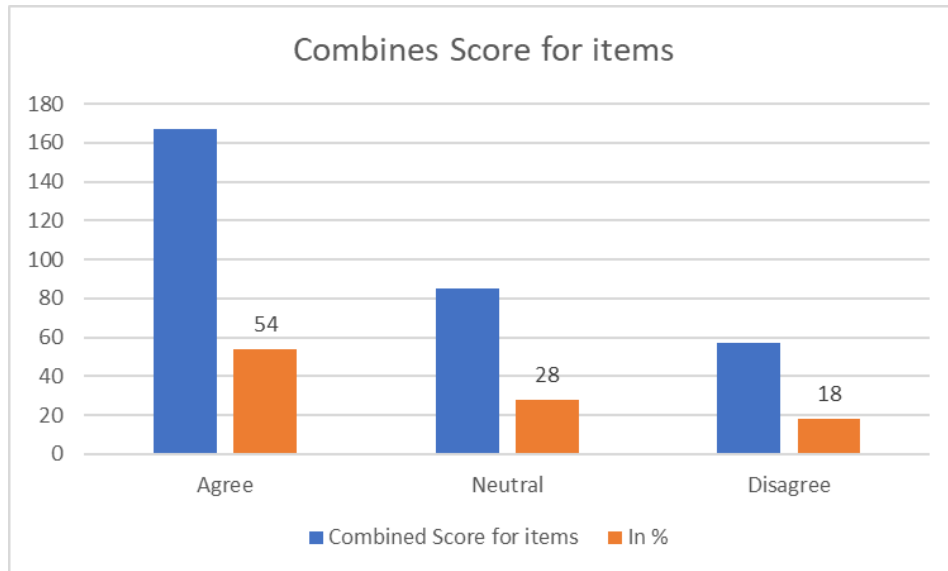


Figure 4.1(b) Combined Results of Survey responses as in figure 4.1(a).

#### 4.1 Finding the difference in performance between students in blended and non-blended courses

Here, students' performances in terms of final grades achieved in the BL courses offered are investigated and compared these grades to those for the same courses offered in the previous semester in a non-blended method. The comparison methodology (independent sample *t*-test) was carefully chosen to assess whether the students in the BL courses had an edge over those in the non-blended ones.

The mean and standard deviation (*SD*) were calculated from the grade point data. Table 4.1 shows that there was a significant difference between the mean scores of the non-blended group ( $M = 2.26$ ) compared to the blended group ( $M = 2.96$ ). The calculated effect size (Cohen's *d*) is 0.271, which is considered a medium effect (Cohen, 1988). It also shows the *t*-value to be 11.88 with a *p*-value  $< 0.001$ , which clearly indicates a very significant effect (improved performance) in the blended learning group.

Table 4.1: Independent sample *t*-test for the final scores.

Group	Mean	SD	N	<i>df</i>	<i>p-val</i>	<i>t-value</i>
<b>Non-blended</b>	2.25	1.320	3020	5700	p < 0.001	<b>11.88</b>
<b>Blended</b>	2.96	1.321	2682			

Table 4.2 shows a few course-by-course significance of the blended learning approach over the non-blended mode. It has been seen that in 15 out of 18 blended courses, a significant performance improvement was achieved in terms of the students' grades. It is worth noting that around 50% of the total classes were conducted over the Zoom platform due to the COVID-19 pandemic. Students were thus significantly immersed in the technological environment

compared to in previous semesters. We think the combination of blended learning and increased technological use contributed to the massive improvement in performance observed in the BL-based courses.

Table 4.2: Independent sample *t*-test for the final scores for a few courses.

Course Name	Non Blended M(SD)	Blended M (SD)	t-value
Biomedical Instrumentation	3.63(0.55)	3.49(0.87)	0.71
Chemistry	2.06(1.27)	3.29(0.8)	17.05*
Computer Graphics	2.9(1.09)	3.55(0.67)	5.73*
Cost and Management Accounting	1.66(1.68)	2.98(0.92)	8.06*
English Language	2.47(1.13)	3.14(1.39)	4.38*
Environmental Engg.-III	2.25(1.17)	3.74(0.72)	11.03*
Export-Import Management	2.3(1.18)	2.54(0.68)	1.39
Geology & Geomorphology	2.59(1)	3.38(0.66)	7.67*
Numerical Analysis and Statistics	2.22(1.19)	3.52(0.76)	12.95*
Physics	1.91(1.32)	3.27(0.83)	19.2*
Wet Processing-I	1.71(1.27)	3.29(0.86)	13.11*
Yarn Manufacturing-I	2.57(1.13)	3.21(0.9)	5.09*

\* $p < 0.001$ , *SD*= Standard Deviation, *M* = Mean

Table 4.3. Independent sample *t*-test for final grades between the groups based on achievement level.

Achievement Level	Course type	Mean	SD	t-value
<b>High achievers</b>	<b>Blended</b>	3.75	0.38	9.16*
	<b>Non-blended</b>	3.42	0.74	
<b>Average achievers</b>	<b>Blended</b>	3.48	0.71	18.40*
	<b>Non-blended</b>	2.38	1.16	
<b>Low achievers</b>	<b>Blended</b>	3.00	0.97	23.73*

	Non-blended	1.39	1.22	
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\*  $p < 0.001$

#### 4.2. Comparing students' performance versus achievement levels

Here, our objective was to investigate whether Blended Learning (BL) affects any specific group(s) of students. We categorized the students who had participated in the blended and non-blended forms of the courses into three different groups based on their pre-CGPA. Table 4.3 summarizes the results with the conclusion that the students showed better performance in the blended courses, irrespective of their achievement levels.

#### 4.3. Relationship between learners' perceptions, motivations, digital literacy, attitude towards learning and final score in a blended course

We compared students' perceptions with their achieved grades to see whether there was any correlation. We similarly looked for any correlation among other factors, such as attention, confidence, satisfaction and relevance. To assess correlations, we employed Pearson's correlation with 11 variables: such as final grade, digital literacy, course design, etc. The last two variables were isolated from the "Attitude towards thinking and learning" portion of the survey (Galotti et al., 1999).

The results (Figure 4.2) suggest there is a significant relationship between the learning experience and course design, with  $r = 0.77$  and  $p < 0.01$ . Satisfaction was strongly correlated with almost all the remaining variables, with  $p < 0.01$

	1	2	3	4	5	6	7	8	9	10	11
Final grade (1)	1										
Digital literacy (2)	.12*	1									
Course design (3)	.07	.52**	1								
Learning experience (4)	.03	.52**	.77**	1							
Personal factor (5)	-.02	-.46**	-.52**	-.48**	1						
Attention (6)	-.02	.24**	.49**	.42**	-.04	1					
Relevance (7)	.09	.44**	.59**	.59**	-.30**	.51**	1				
Confidence (8)	-.04	.30**	.36**	.46**	-0.01	.41**	.55**	1			
Satisfaction (9)	.11*	.44**	.66**	.65**	-.28**	.54**	.65**	.60**	1		
CK (10)	-.04	.30**	.29**	.32**	-.11*	.24**	.47**	.51**	.38**	1	
SK (11)	-.05	.15**	.24**	.25**	.01	.34**	.42**	.52**	.33**	.63**	1

Figure 4.2. The Correlations between learners' perceptions, motivations, digital literacy, attitudes and final grades.

#### 4.4. Relationship between self-regulated learning behavior and students' learning performance

Table 4.4 shows the stepwise regression model summary of the students' self-regulated learning behavior indicators for their final scores. Four independent variables - forum access, login frequency, course view, and file access were entered in the regression analysis. Among these, two variables were less significant predictors, namely forum access and login frequency. Model 2 was the better fit, explaining 3% of the variance in the final scores,  $F(2,974) = 15.958$ ,  $p < .05$ .

Table 4.4: Model summary for stepwise regression analysis.

Dependent Variable	Predictor	Model 1	Model 2
		$\beta$	$\beta$
Final scores	Forum access	.079*	.239*
	Login frequency		-.226*
Adjusted R <sup>2</sup>	s	.005	.030
F change		6.059	15.958
Sig. F change		.014	.000
* $p < .05$			

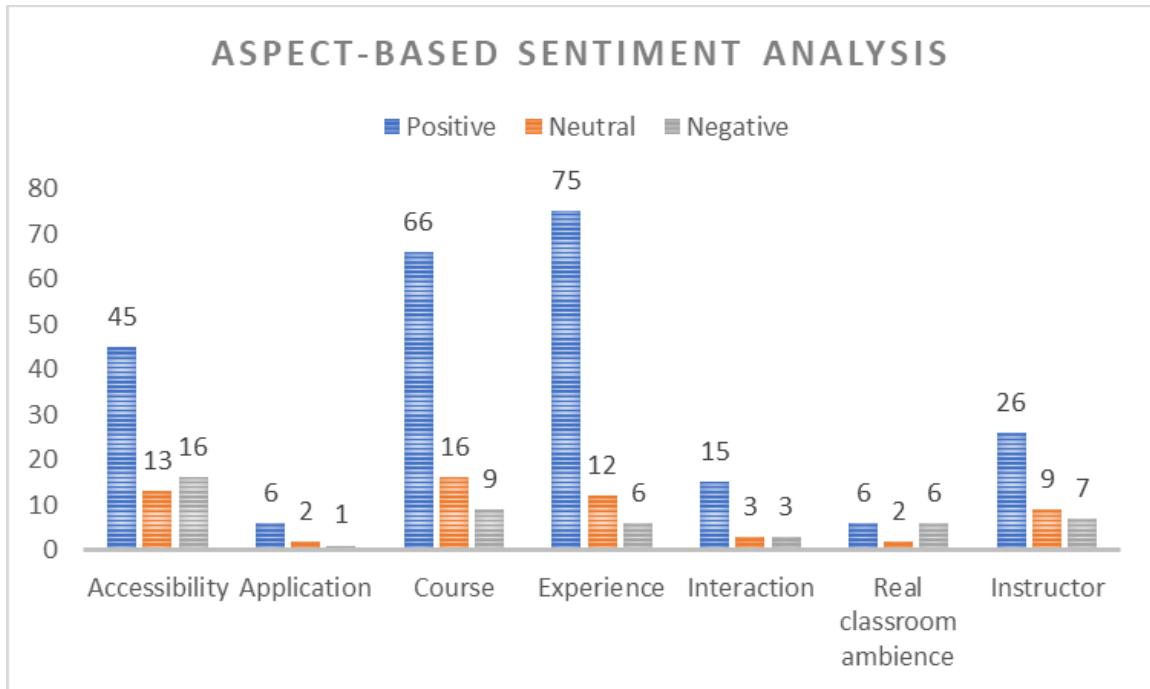


Figure 4.3: Aspect based sentiment analysis of the students' feedback

#### 4.5. Analysis of learners' personal opinions on the effectiveness of the BL environment for their course of study

The survey included one open-ended question, where respondents were free to write their opinions regarding the blended learning course. We performed aspect-based sentiment analysis (F1 score of 0.62) on the collected data. The data were labeled with seven predefined classes: instructor, real classroom ambience, interaction, experience, course, application and accessibility using active learning. We applied group-wise sentiment analysis using the Microsoft Azure data analysis platform in Microsoft Excel 2013 for the polarity values of all the comments. A summary of the polarity values is shown in Figure 4.3 which were mostly positive.

#### 4.6. Impact of the training and mentoring program on the teachers' experience of designing and teaching in a BL environment

Using interviews of the 20 teachers participating in the study, we employed an activity theory framework (Figure 4.4) to analyze the resulting data. It has six elements: subject (participating teachers), object (quality of the training the subjects received), tools (The Moodle LMS), community (key actors namely the teachers, training providers, AUST management authority, and the ICT center with all its support staff), rules (The AUST's TEL policy), and division of labor (challenges the teachers faced during the BL implementation).



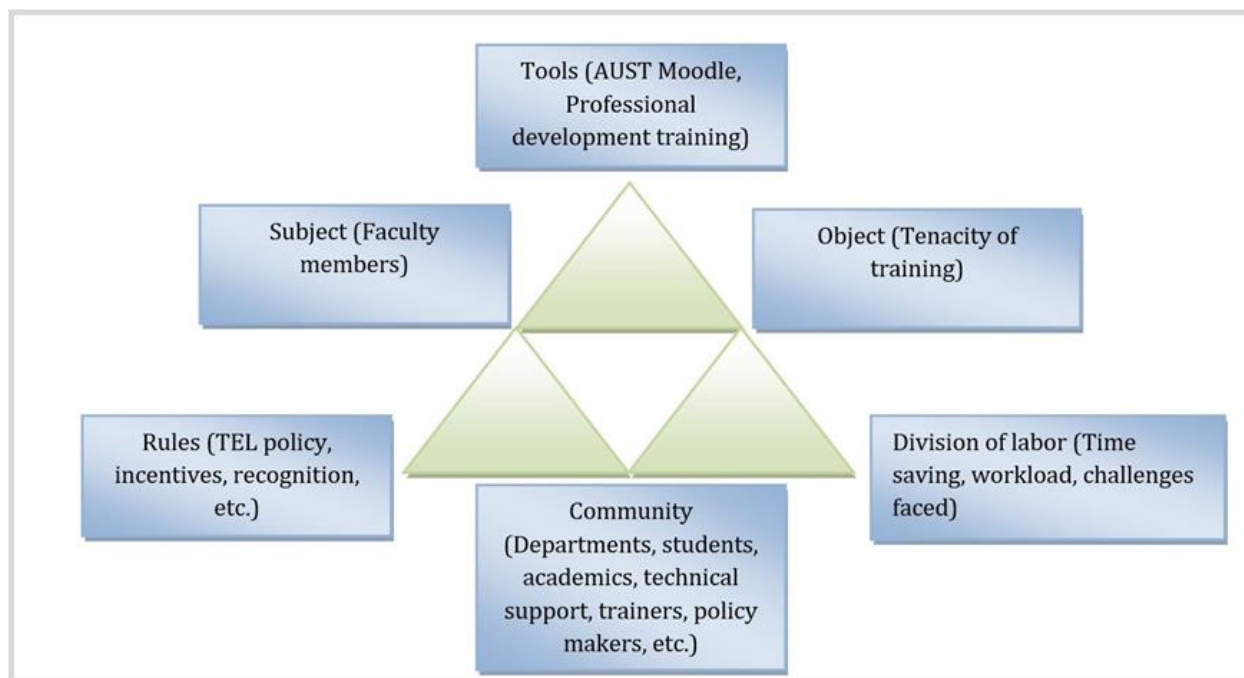


Figure 4.4. Activity system triangle based on Engeström's (1987) activity system.

#### 4.6.1. SUBJECT–TOOLS–OBJECT

All 20 of the interviewed faculty members had received training on how to use Moodle properly. The interview data indicated the faculty members were highly satisfied with the training. It introduced them to the requisite technological tools, which in turn was reflected in their experience of carrying out their courses effectively.

#### 4.6.2. TOOLS–RULES–DIVISION OF LABOUR

AUST has gradually developed a TEL policy. AUST also ensures that the technical support staff for TEL provide excellent help and that parties receive the required ICT devices, evidence of which was found in the teachers' review. The teachers also felt that the AUST Moodle LMS was quite flexible and convenient to use.

#### 4.6.3. SUBJECT–RULES–COMMUNITY

AUST's top management — the Chairman of the Board of Trustees, Vice-Chancellor, Treasurer, Deans, and Heads of the Departments/School — came forward to inspire faculty members to use a blended learning model in their courses. Having a well-established TEL policy also played a vital role in this regard.

#### 4.6.4. SUBJECT–COMMUNITY–OBJECT

The major issue was found in this triad, in faculty members' responses to the question: "To what extent are your colleagues aware of blended learning?" Their comments suggested that many believed their colleagues were not very aware of the BL model. Figure 4.5 presents the results on a 5-point scale from lower to higher awareness.

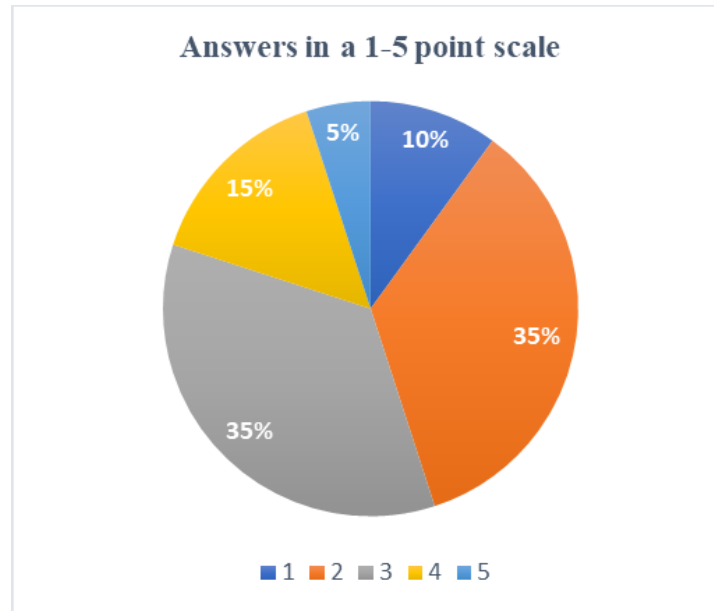


Figure 4.5: Teachers' response to the interview question

#### 4.6.5. OBJECT-COMMUNITY-DIVISION OF LABOUR

This triad in the activity theory framework highlights the significance of teamwork, and faculty statements support this. COL promotes the practice of collaboration to develop a sense of community within organizations implementing TEL. Continuous review of comparable courses, the provision of necessary feedback, and continuous social interactions within the community can disseminate positivity, which can bring overall improvement to TEL implementation by overcoming unforeseen challenges.

### 5. RECOMMENDATIONS

The following recommendations came out from this study, which may be useful for further enhancement of the quality of blended learning implementation at AUST:

#### IMPROVED AND STABLE INTERNET CONNECTIVITY

The research recommended AUST move towards increased bandwidth for Internet connectivity. In addition, reliable and stable Wi-Fi coverage throughout the classrooms and open spaces of the AUST campus would allow students to access digital content anytime, from any type of device, without a hassle.

#### OVERHAULING THE LEARNING MANAGEMENT SYSTEM

The Moodle LMS requires proper fine-tuning to accommodate users' suggestions and introduce more features that may help them operate the LMS with more flexibility in the future. A version upgrade is recommended, to gain updated features and greater stability. Building customized Moodle plugins that meet additional student demands is recommended using custom APIs.

#### ENGAGING THE STUDENTS THROUGH TRAINING TO USE THE LMS PROPERLY

Data analysis revealed a significant relationship between the learners' digital literacy and their final grade, implying that a learner with better digital literacy achieved better grades in the blended courses. Training the students properly on the various features of Moodle and how to access them effectively can lead to additional performance gains. AUST students could also be encouraged to take COL's C-DELTA course to develop digital education skills.

#### TRAINING FOR THE TRAINERS

There is a close relationship between students' learning experience and good course design. It is very important to continuously monitor and enhance the BL course structure, upgrade materials, and finetune course contents. In addition, to keep trainees engaged, it is also important to ensure the course design is interesting and appealing. Professional training for teachers must therefore be continued.

### **ENSURING LEARNERS AND TEACHERS HAVE ACCESS TO THE REQUISITE DIGITAL DEVICES**

The research recommends enhancing the current support provided to teachers by offering them the necessary devices either free of cost or on a flexible payment system. AUST may wish to update its TEL policy accordingly and consider providing similar devices and connectivity support to students as well.

## **6. CONCLUSION**

In this study, we formulated several research questions and approached learners and teachers to search for answers, in order to assess the impact of blended learning at Ahsanullah University of Science and Technology. The results showed that students using the BL method received significantly better grades than those in the non-BL group. This outcome is in line with the findings of some earlier authors (Asarta & Schmidt, 2017; Angelini & García-Carbonell, 2019; Lin et al., 2017) who have generally found that students perform better in a BL environment. Our obtained results also showed that irrespective of their category, students had significant performance improvement. Authors of another study (Owston et al., 2013) suggested there may be significant performance improvement in BL-based courses only for high-achieving learners. Surprisingly, in our study, the difference in final grades between non-blended and blended groups was much higher for the low-achiever group. This result is a vote in favor of blended learning. We think the students were more focused on the course materials, could ask for clarification at any time, and communicate with their peers more freely than in a classroom-only face-to-face environment. From various statistical analyses, we saw that there were significant correlations between digital literacy, motivation, learners' perceptions, and final grades. From the trainers' point of view, they acknowledged that although they found it slightly difficult to design a course curriculum at the beginning, they gradually got used to the TEL environment.

The results of the self-regulated learning behavior of the students showed it had a negligible effect on their final scores. Notably, students with more forum participation had a slight edge in terms of final score over those who participated less in group discussions. Aside from a few students experiencing discomfort in some areas, the application of blended learning at AUST boosted students' happiness and overall academic results.

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