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Impact of the Technology-Enabled Learning at MIER

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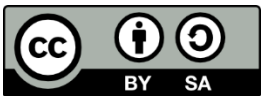

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Acknowledgements
This report was prepared by Dr Mool Raj under the guidance of Dr Adit Gupta, Director, MIER. We also thank Dr Sanjaya Mishra, Director: Education, Commonwealth of Learning, for his valuable suggestions to improve this report.

Published by:
COMMONWEALTH OF LEARNING
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Acronyms

AT	Activity Theory
ATTL	Attitude Toward Thinking and Learning
BL	Blended learning
BLCES	Blended Learning Course Experience Survey
CET	Centre of Educational Technology
CIS	Course Interest Survey
COL	Commonwealth of Learning
DLAT	Digital Literacy and Access to Technology
EFL	English as a Foreign Language
FS	Final Score
ICT	Information and Communication Technology
LMS	Learning management system
MCE	MIER College of Education
MeBL	Moodle-enabled blended learning
MIER	Model Institute of Education & Research
MIET	Model Institute of Engineering & Technology
MOOCs	Massive Open Online Courses
MS	Microsoft
N	Negative
NEP	National Education Policy
NEU	Neutral
NONE	None
P	Positive
P+	Highly positive
Sig	Significant
SPSS	Statistical Package for the Social Sciences
TEL	Technology Enabled Learning

Executive Summary

This report evaluates blended learning implementation at the Model Institute of Education and Research (MIER), J&K, India. The study assessed the effectiveness of blended learning (BL) for students' learning performance and their perceptions about BL. In addition, it examined the relationship between online activities and final scores. Students' online activities were tracked and collected from the MIER College e-learning management system (MCE-ELMS). The sample for this study included 6 teachers and 302 students enrolled in 20 courses offered during the April 2022 semester. A convenience sampling method was employed to collect the survey data. For quantitative data analysis, an independent sample t-test, a Pearson correlation coefficient, and a likelihood-ratio test were used. Aspect-based sentiment analysis was performed on the students' views in response to one open-ended question. The teachers' interviews were also conducted. The interviews were analysed using the Activity Theory (AT) framework (Engeström, 1987).

The results of the learning performance assessment showed a significant difference between the students' outcomes in the blended and non-blended courses. Overall perceptions of the students towards blended learning were significantly positive. A majority of the students agreed that learning through a blended approach was very helpful and beneficial, and they were confident that they could adopt this approach for learning in future as well. They also expressed that the BL course made learning more interesting, engaging, enjoyable, interactive, and beneficial. There is significant difference in the learning performance of students who had studied through a blended course as compared to ones who had studied in a non-blended course. The faculty members expressed a high level of satisfaction with the training provided to them regarding these courses. The teachers also appreciated the technical support provided to them by the college and access to modern ICT tools which helped them in enhancing their BL course development skills. The faculty members also said that regular trainings, cooperation and collaboration with other institutions are crucial for creating and enhancing the quality of their blended courses in future, as well.

1. Introduction

1.1 Background

Technology-Enabled Learning (TEL) is the use of any technology that enhances the learning experience. The term can be used to describe both analogue and digital technologies, but more recently, we see that digital TEL is taking over education in the form of different types of educational software. TEL is

transforming and enhancing education and educational institutions beyond recognition. Therefore, it is impossible to be ignored! This is especially true given the growing prevalence of education apps, software for teachers, and e-learning services. We are entering a phase of education where technology isn't just a valuable resource, but an essential tool helping to improve the experience for both students and educators (Cullen, 2019). TEL is important for many reasons. It is not only important because it is the standard of education that is expected today, but it can also improve education. Students have become more tech-savvy than ever before and much of their day is spent interacting with some form of technology. Thus, the ease with which they navigate technology, and their comfort level means that in a society increasingly dominated by ever-developing smartphones, tablets, computers and more, students today expect and indeed thrive when interacting with technology. Thus, educators can use this burgeoning tech-savviness by using technology to improve interaction, engagement, and understanding within their classrooms (Cullen, 2019).

Proper use of TEL can aid rapid growth in education, eliminate barriers in teaching and learning, and of space and time resulting in lifelong learning. TEL can offer methods and tools to solve problems faced by educators and students in higher education. Teachers will have better means to communicate with students and achieve better classroom management and resources to save time in tailoring teaching content. On the other hand, students will feel inspired, empowered and confident with the course they will be taking (Jotheeswaran, 2020).

There is evidence of increasing amounts of online learning delivery (Bates, 2018; Allen & Seamen, 2016) reshaping higher education through Web-based content delivery and interaction. The shift to online and blended teaching and learning provides new opportunities for content delivery, interaction, and facilitation of learning. The success of online or blended learning delivery is, to a large extent, dependent on the knowledge, expertise, support and leadership available in the transition to this new way of learning. In addition, quality teaching is a long-standing challenge in higher education where faculty are not certified to teach. In order to use online and blended learning, but maintain or enhance quality teaching, more work to identify, disseminate, and implement best practices is required (Cleveland-Innes, Gauvreau, Richardson, Mishra & Ostashewski, 2019).

The Ministry of Education in India, through its National Education Policy 2020 (MOE, 2020), has also emphasised the adoption of the Blended Learning approach for teaching and learning across all higher education institutions across the country. The NEP 2020 explains that Blended Learning is an instructional methodology, a teaching and learning approach that combines face-to-face classroom methods with computer mediated activities to deliver

instruction. This pedagogical approach means a mixture of face-to-face and online activities and the integration of synchronous and asynchronous learning tools, thus providing an optimal possibility for the arrangement of effective learning processes. Blended learning is the term given to the educational practice of combining digital learning tools with more traditional classroom face to face teaching. A blended learning mode provides ultimate flexibility in many aspects. It can be applied to any program which holds on to the values of traditional learning and incorporates digital media with that. It is a lot more effective and likeable than anything that has been ever before. Students, academicians, policy makers etc. appreciate the needed freedom/flexibility. Only a well-crafted blended solution can provide a seamless transition from classroom to computer or vice-versa. Though there are many teaching methods and techniques, available resources indicate that blended learning mode is the "best of all worlds." As reiterated by NEP 2020, the blended learning approach is considered to be the best because it helps all learning requirements and styles through a variety of mediums and techniques. Recently, many learning platforms globally have adopted blended learning which is also one of the most adopted learning tools (MOE, 2020).

This new learning dynamic benefits students and teachers alike. Giving students permission and space to become active learners who gain knowledge directly and lets them assume some control over their learning helps them develop self-reliance. As more students are working independently, time opens up for teachers to provide face-to-face support and individualized instruction more frequently for more students, effectively improving differentiation. Blended Learning provides teachers with a fuller, more accurate picture of how each student is doing. It yields more frequent and more personal teacher interaction with individual students and teachers have the opportunity to deepen and strengthen student/teacher relationships. The trust that comes with close relationships can give teachers insights into students' personal struggles and needs- insights which empower teachers to comfort and coach students through challenges that often serve as obstacles to learning. In summary, Blended learning combines the best aspects of online learning with the best aspects of direct instruction, helping teachers easily manage to do much more to meet student needs without adding to an already weighty workload (NEP, 2020). The draft policy document issued by the University Grants Commission proposes that the teaching learning activities be divided in the ratio of 60:40 with 60% of the classroom transaction shall be in the face-to-face mode and 40% of the content shall be delivered through a Blended Learning approach using MOOCS and Open Educational Resources (UGC, 2021).

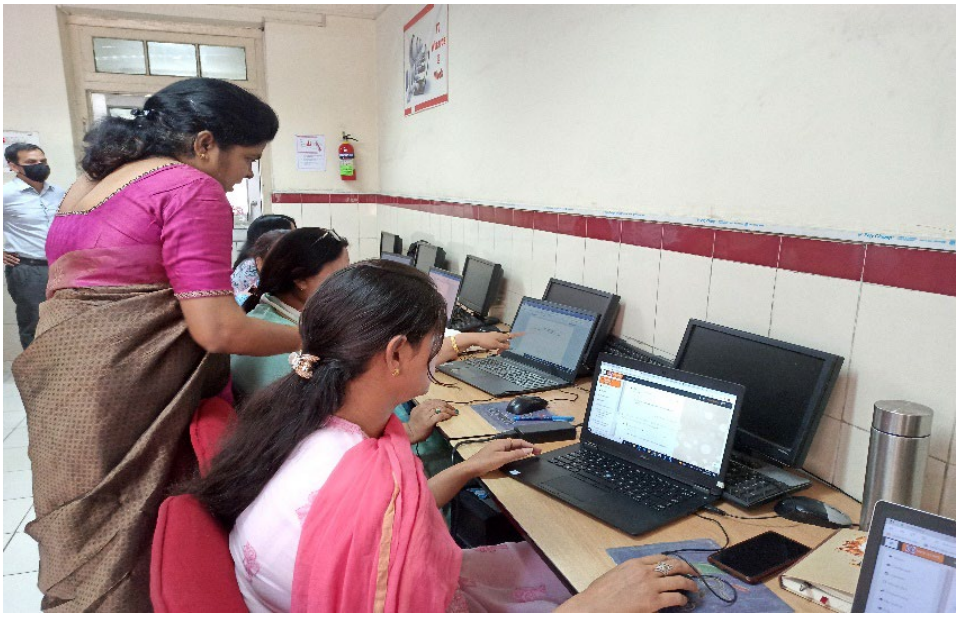
1.2 TEL Environment at MIER

The use of technology at the MIER group of institutions, especially MIER College of Education and MIET, is extremely important for imparting 21st-century skills to our students. MIER works on the premise that our learners should be skilled in the use of modern technologies during their education to help them transition to job scenarios in actual schools and industries. This makes them tech-savvy and more employable than other learners who have not been exposed to technology. The use of technology is also important from the faculty point of view, as in order to use the latest software and educational technologies in class, staff needs to have the requisite ICT skills to be successful educators and easily disseminate knowledge to their trainees. With the system of education being completely dependent on the use of ICT, it is imperative for any organization to have a sound policy that governs the implementation of modern educational technologies and promotes the creation of technology-enabled learning environments across all educational programmes.

The Commonwealth of Learning (COL) has been supporting the MIER group in implementing TEL through a systematic process since 2021. In this process, COL in collaboration with the MIER College of Education (MCE) and Model Institute of Engineering and Technology (MIET) has conducted a baseline study (Raj, 2021) to ascertain the TEL implementation in both the institutions, developed a TEL policy[1] that MIER has adopted with a clear roadmap for TEL initiatives, supported the faculty in building capacity to develop blended learning courses, and developed 20 blended courses that were offered in the April 2022 semester. As part of a systematic approach to TEL implementation, COL has supported the following capacity-building activities at MIER both in online and on-campus modes:

- Workshop on Policy Development for Technology-Enabled Learning (Online from 28th June to 30th June, 2021)
- Workshop on Developing Blended Learning Courses Using Moodle (Online from 13th December to 17th December 2021)
- Workshop on Blended Course Development (on campus) from 28th March to 30th March 2022

[1] https://www.miercollege.in/adminpanel/files/251202312491235.pdf



This study was undertaken as part of the COL supported TEL implementation at MIER to understand end assess the impact of the use of technology in teaching and learning at MIER.

1.3 Research Questions

The study assesses and investigates the effectiveness of the blended learning programmes which were developed as part of the COL project. Following are the research questions that guided the study:

1. Is there any significant relationship between Learners Perceptions on Digital Literacy, Course Experience, Course Interest, Attitude Towards Learning and their final scores in a blended course?
2. How do learners describe the effectiveness of the blended learning environment in their course of study?
3. Is there any significant difference in participants' learning performance between blended courses and non-blended courses?
4. What impact does a training and mentoring programme have on the facilitators' experience of designing and teaching in a blended learning environment?

2. Review of Literature

Mishra (2020), in his research on technology applications in education, has highlighted the significance of ICT in education policies in the context of national development and has presented a case for the systematic and evidence-based deployment of ICT in teaching and learning. A review of some technology applications in teaching and learning have been conducted that have supported

quality teaching and learning at different levels of education such as video learning, mobile learning, learning management system, Social media, open educational resources, MOOCs etc.

A study conducted by Koneru (2020), on designing blended learning courses for improving student learning, reveals that when technology is pedagogically integrated with course design, transformative instructional practices and improved learning outcomes can result. The results also showed that blended learning environment provided the teachers with a flexible teaching environment and enabled them to enrich students' learning experience with a mix of instructor-led teaching and TEL as well as traditional and interactive multimedia. The comparison of student learning achievement in blended and non-blended courses showed mixed results, with improvement in performance of students in over 50% of the courses was reported.

Research by Abeka and Bosire (2020) highlights the implementation of technology-enabled learning (TEL) for enhancing learner engagements in the classroom. The findings demonstrated that TEL implementation through adopting blended learning did improve learners' engagement with learning activities and empowered students to be independent learners. Although students were positive about blended learning, they still considered the teacher essential for learning and classroom engagement. However, to engage students in deeper understanding, blended learning must be designed specifically to encourage autonomy through interactions, collaborations and participation in challenging activities.

Wu and Luo (2021) examined how students and instructors perceived the incorporation of MOOCs in students' blended learning experience and the challenges they encountered. A total of 122 second-year undergraduates enrolling in an English course were surveyed, and five students and three lecturers were interviewed. The finding showed that students had favourable attitudes toward the blended course, expressing a higher level of interaction, flexibility, a better understanding of the learning content and a richer learning experience. The instructors confirmed the positive impacts of blended learning but also admitted blended teaching increased their time commitment to their jobs.

Minhas et al. (2021) conducted a qualitative study using focus groups to gather teacher perspectives of blended learning models and came out with three major themes related to professional development, student success and blended courses. Their experiences and perceptions provided highly relevant insights on what constitutes an effective blended leaning model. The study highlights effective communication, course materials, course design and how blended

learning environments are set-up, as crucial elements of an effective blended learning model. Teachers perceived these elements as the biggest influences on student success.

Majeed and Dar (2022) investigated the efficacy of a blended mode of learning in ESL (English as a Second Language) classrooms in Pakistan under the theoretical construction of Transactional Distance Theory. For this purpose, the data was collected for pre-test, post-test and self-administered questionnaires from 499 ESL learners of private universities in Pakistan which were offering blended learning programs. The post-test results indicated significant improvement in students' English language proficiency. The results also confirmed that most of the factors, namely ease of use, computer literacy, need for face-to-face interaction, pre-built learning mechanism and resistance to change, have a significant relationship with blended learning except the two factors namely, technical difficulty during the attempt and student assistance in the lab.

An investigation of the simultaneous implementation of 38 blended courses in a private Brazilian university was carried out by Barbosa (2022). The general objective of this study was to assess whether instructional design and course management practices, as well as interaction, affect students' instruction. Through the use of Structural Equation Modelling, this study found out that instructional design positively influences instruction, especially when mediated by interaction. This study did not find a significant effect of course management over instruction as well as presenting some implications to instructional designers and teachers of blended courses.

Ramli et al. (2022) explored the perspectives of three pre-service teachers and 27 students towards blended learning (BL) practices in the EFL context. The findings uncovered that the teachers and students gave positive perspectives to apply the BL model to the new normal. In addition, BL could reshape the teachers' roles by applying multiple technology use in the teaching and learning process. BL was also able to broaden students' learning experience. This study highlighted some implications, including the need for pre-service teachers' professional development that ultimately will help teachers assist students in succeeding in blended learning.

The review of the literature conducted in this study highlights the importance of the blended learning approach in learning. Adoption of blended learning at various levels of education has enriched the students' learning experiences, enhanced classroom engagement, promoted deeper understanding and helped develop favourable attitude in students and teachers towards technology-enabled learning. Overall, the blended learning environment contributed

towards the success of students in terms of what they learnt and how they were assessed.

3. Methodology

3.1 Research Design and Sample

The present study followed a mixed-methods approach. A total of 302 students enrolled in 20 courses offered during the April 2022 semester participated in the study. At the end of the course, participants were asked to respond to a questionnaire. The student questionnaire was adapted from Bhagat (2021) and contained 76 closed questions and one open-ended question. A convenience sampling method was employed to collect the survey data. The gender distribution was 56 males and 246 female students. Participants' percentage in the previous examination and final percentages in the blended and non-blended courses were collected from the college academic records. The qualitative data were comprised of participants' responses to the open-ended question in the questionnaire and teachers' responses in the interview with the researchers. The interview questions for facilitators addressed their experience of designing and teaching a blended course. These questions were adopted and modified from the study by Mishra (2017). Six teachers participated in the interviews.

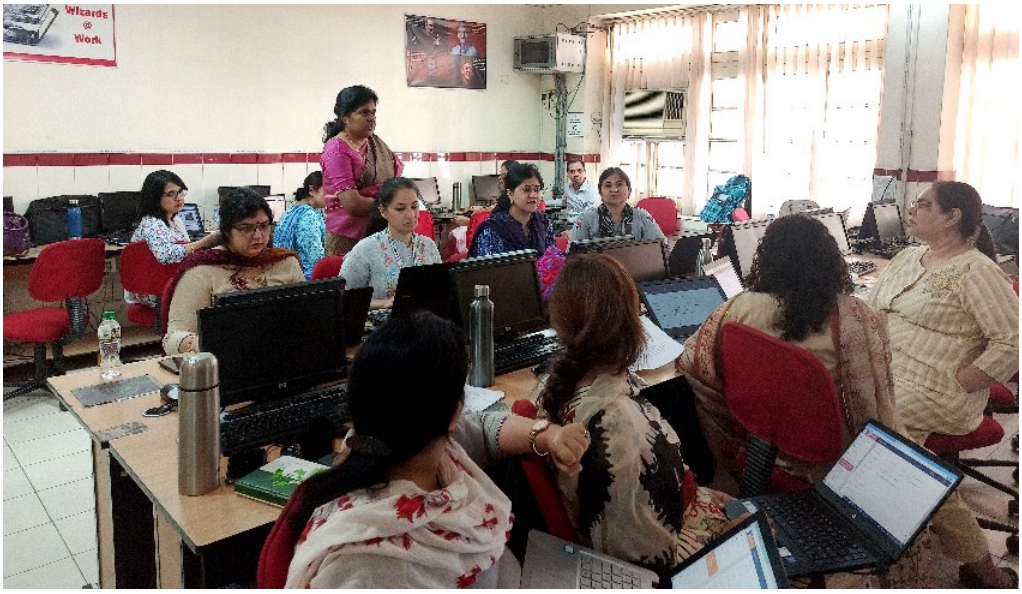
3.2 Tools

Four questionnaires were used to collect the data: Digital Literacy and Access to Technology (DLAT), Attitude Toward Thinking and Learning (ATTL), Course Interest Survey (CIS), and Blended Learning Course Experience Survey (BLCES). Except for demographic information, all the survey items were measured on a five-point Likert scale.

DLAT included three items, and the overall Cronbach's α for DLAT was 0.86. CIS was designed by Keller (2010). The CIS questionnaire included four subscales and 34 items: an eight-item attention subscale; a nine-item relevance subscale; an eight-item confidence subscale; and a nine-item satisfaction subscale. The four factors in the questionnaire had an adequate reliability (Cronbach's α = 0.83, 0.84, 0.84 and 0.83 for attention, relevance, confidence and satisfaction, respectively). The overall Cronbach's α for CIS was 0.84. The ATTL scale was developed by Galotti et al. (1999) and consisted of 20 items. The overall Cronbach's α was 0.84. The BLCES was based on the instrument used by Koneru (2019) to measure participants' Blended Learning experience. The three factors of the BLCES had adequate reliability (Cronbach's α = 0.85, 0.85 and 0.93 for course design, learning experience and personal factor, respectively). The overall Cronbach's α for BLCES was 0.86.

3.3 Data Analysis

For quantitative data analysis, an independent sample t-test, a Pearson correlation coefficient, Chi Square test and a likelihood-ratio test were used. The students and teachers' interviews were fully transcribed and cleaned. The transcribed interviews were analysed using the framework (Engeström, 1987). All the quantitative analyses were conducted using the Statistical Package for the Social Sciences, version 26 (SPSS 26). The statistical significance level was set at $p < 0.05$.



4. Results of the Study

The researcher collapsed a five-point Likert scale (i.e., strongly agree, agree, neither agree nor disagree, disagree, strongly disagree) into three categories: agree (i.e., strongly agree and agree), neutral (i.e., neither agree nor disagree) and disagree (i.e., disagree and strongly disagree). The likelihood ratio test was employed to check the significant difference between the proportions of agreeing, neutral and disagreeing (Table 1).

For the DLAT scale, the overall score showed a significantly higher proportion of respondents agreeing (94.4%) than being neutral (4.8%), but a miniscule number of students (0.7%) disagreed in their view. For the BLCES scale, in regard to the two-factors i.e., course design, the learning experience, more participants (Over 90%) agreed with the statements than disagreed. With regards to personal factors about 48% agreed with the statements, 36.3% disagreed while 15% remained neutral. However, statistically there is a significant trend in opinion as the value of Chi-square is significant at 0.01 level of significance.

For the CIS scale, the factor "attention" showed a significantly higher proportion of respondents agreeing (75.5%) than disagreeing (9.5%) and remaining neutral (15%) in their view. The factor "relevance" also showed that significantly more students agreed (73.8%) than disagreed (7.5%). These proportions were similar for "confidence," with significantly more students agreeing (77.8%) than disagreeing (9.1%), but 13% showed a neutral view. Similarly, for "satisfaction" significantly more students agreed (82.6%) than disagreed 7.1%), and only about 10.2% were neutral in their view.

For the ATTL scale, the overall score showed a significantly higher proportion of respondents agreeing (79.1%) than disagreeing (7.1%), and only 13.7% students had a neutral view.

Table 1. Frequency of Participant Response to Categorised Questionnaire Items.

Questionnaire Item	Disagree	Neutral	Agree	$\chi 2$
Digital Literacy and Access to Technology				
My digital literacy (use of MS Office, browse the Web and navigate through the Virtual Learning Environment) skills are excellent	3	11	254	
My access to and use of digital tools (Laptop, Smartphone) are excellent	0	10	258	454.13*
My ability to access and use the MIER Learning Management System was excellent	2	17	249	
Total	2	13	254	
BLENDED LEARNING EXPERIENCE				
Course design	Disagree	Neutral	Agree	$\chi 2$
Description of module objectives, learning activities and assignments in the online module was excellent	5	13	247	
Expression of expectations for performance (e.g. online forums and assignments) in the module was excellent	5	14	246	
The professor's overall organization of the course was great	3	11	251	
Continuity between face-to-face class and online learning was good	4	14	247	424.19*
The pace of the module was user friendly	4	21	240	
The professor's interest in your learning was good	6	9	250	
The professor's feedback on your performance in assignments and participation in the forums was very helpful	5	17	243	

The professor provided orientation on use of the online resources, activities and MIER Learning Management System was very helpful	4	15	245	
Overall the course experience was excellent	6	12	247	
Combined Score	5	14	246	
Learning experience	Disagree	Neutral	Agree	χ2
Multimedia resources on MIER's Learning Management System enriched my learning experience	3	17	245	395.84*
Communicating online with students and the professor improved my learning	8	19	238	
Blended learning improved my time-management skills	5	20	239	
Blended learning improved my digital literacy	2	11	250	
Blended learning improved my performance in mid-semester test and end-semester exams	6	21	237	
Blended learning enabled me to learn at any time, any pace, from anywhere, using any device	4	21	239	
Use of Moodle mobile app for viewing / reading learning resources; interacting with Faculty and peers in forums; and submitting assignments was satisfactory	9	21	234	
Combined Score	5	19	240	
Personal factor	Disagree	Neutral	Agree	χ2
I feel more anxious in this course	91	41	132	44.67*
I have trouble using the technologies in this course	138	21	105	
This course required more time and effort	59	59	147	
Combined Score	96	40	128	

COURSE INTEREST

Attention	Disagree	Neutral	Agree	χ2
The professor knows how to make us feel enthusiastic about the subject matter of this course	1	16	236	203.12*
This course has very little in it that captures my attention	49	47	157	
The professor creates suspense when building up to a point	21	56	176	
The students in this course seem curious about the subject matter	11	40	202	
The professor does unusual or surprising things that are interesting	12	33	208	
The professor uses an interesting variety of teaching techniques	4	21	228	

I often daydream while in this course	86	51	116	
My curiosity is often stimulated by the questions asked or the problems given on the subject matter in this course	7	42	204	
Combined Score	24	38	191	
Relevance	Disagree	Neutral	Agree	χ2
The things I am learning in this course will be useful to me	2	17	234	
The professor makes the subject matter of this module seem important	3	14	236	
I do not see how the content of this course relates to anything I already know	60	59	134	
In this course, I try to set and achieve high standards of excellence	2	22	229	
The content of this course relates to my expectations and goals	7	260	220	211.34*
The students actively participate in this course	6	21	226	
To accomplish my goals, it is important that I do well in this course	2	26	225	
I do not think I will benefit much from this course	100	29	124	
The personal benefits of this course are clear to me	4	23	226	
Combined Score	21	52	206	
Satisfaction	Disagree	Neutral	Agree	χ2
I have to work very hard to succeed in this course	14	30	209	
I feel that this course gives me a lot of satisfaction	6	22	225	
I feel that the grades or other recognition I receive are fair compared to other students	4	30	219	
I enjoy working for this course	8	17	228	
I am pleased with the professor's evaluations of my work compared to how well I think I have done	3	19	231	277.78*
I feel satisfied with what I am getting from this course	4	16	233	
I feel rather disappointed with this course	110	34	109	
I feel that I get enough recognition of my work in this course by means of grades, comments, or other feedback	6	34	213	
The amount of work I have to do is appropriate for this type of course	7	30	216	
Combined Score	18	26	209	
Confidence	Disagree	Neutral	Agree	χ2

I feel confident that I will do well in this course	4	13	236	
You have to be lucky to get good grades in this course	37	32	184	
Whether or not I succeed in this course is up to me	5	32	215	
The subject matter of this course is just too difficult for me	92	45	116	
It is difficult to predict what grade the professor will give my assignments	28	52	173	227.58*
As I am taking this course, I believe that I can succeed if I try hard enough	12	31	210	
I find the challenge level in this module to be about right: neither too easy not too hard	6	29	218	
I get enough feedback to know how well I am doing	1	26	226	
Combined Score	23	33	197	
Attitudes Towards Thinking and Learning	Disagree	Neutral	Agree	$\chi 2$
Attitudes towards thinking and learning [I like to understand where other people are 'coming from', what experiences have led them to feel the way they do	7	32	214	
Attitudes towards thinking and learning [The most important part of my education has been learning to understand people who are very different to me	7	31	215	
Attitudes towards thinking and learning [I feel that the best way for me to achieve my own identity is to interact with a variety of other people	8	26	219	
Attitudes towards thinking and learning [I enjoy hearing the opinions of people who come from backgrounds different to mine - it helps me to understand how the same things can be seen in such different ways	3	29	221	242.82*
Attitudes towards thinking and learning [I am always interested in knowing why people say and believe the things they do	7	34	212	
Attitudes towards thinking and learning [I try to think with people instead of against them	12	34	207	
Attitudes towards thinking and learning [I'm more likely to try to understand someone else's opinion than to try to evaluate it	9	27	217	

Attitudes towards thinking and learning [I tend to put myself in other people's shoes when discussing controversial issues, to see why they think the way they do	31	26	196	
Attitudes towards thinking and learning [Through empathy, I can obtain insight into opinions that differ from mine	6	32	215	
Attitudes towards thinking and learning [When I encounter people whose opinions seem alien to me, I make a deliberate effort to 'extend' myself into that person, to try to see how they could have those opinions	10	41	202	
Attitudes towards thinking and learning [In evaluating what someone says, I focus on the quality of their argument, not on the person who's presenting it	12	31	210	
Attitudes towards thinking and learning [I like playing devil's advocate - arguing the opposite of what someone is saying	59	47	147	
Attitudes towards thinking and learning [I find that I can strengthen my own position through arguing with someone who 2s with me	58	44	151	
Attitudes towards thinking and learning [I often find myself arguing, in my head, with the authors of books that I read, trying to logically figure out why they're wrong	48	47	158	
Attitudes towards thinking and learning [It's important for me to remain as objective as possible when I analyse **something**	13	32	208	
Attitudes towards thinking and learning [I have certain criteria I use in evaluating arguments	16	31	206	
Attitudes towards thinking and learning [I try to point out weaknesses in other people's thinking to help them clarify their arguments	24	43	186	
Attitudes towards thinking and learning [One could call my way of analysing **things 'putting them on trial' because I am careful to consider all the evidence**	9	45	199	
Attitudes towards thinking and learning [I value the use of logic and reason over the incorporation of my own concerns when solving problems	3	27	223	

Attitudes towards thinking and learning [I spend time figuring out what's 'wrong' with things. For example, I'll look for something in a literary interpretation that isn't argued well enough	8	36	209	
Combined Score	18	35	201	

** p < .01 Level of Significance*

The data analysis shows that the overall perceptions of the students towards blended learning were very positive. The students were of the opinion that they had the necessary digital literacy skills to learn in a blended learning environment. The overall learning experience of the students was very enriching and encouraging as they were happy with the course design and were able to handle the Moodle-based learning management system (LMS) in an effective manner. The blended learning environment was able to ensure their attention in the course and it was relevant to their area of study. The students also expressed that they were confident about learning through a blended learning approach and were overall satisfied with the progress and evaluation done in the course. They mentioned that blended learning provided them with the flexibility to access the courses at any place and at any time.

Research Question 1

Is there any significant relationship between Learners Perceptions on Digital Literacy, Course Experience, Course Interest, Attitude Towards Learning and their final scores in a blended course?

To accomplish the first research question, Pearson's Coefficient of Correlation was used, and inter-scale correlations were computed. Results in Table 2 reveal that there are positive significant correlations between the four constructs as measured by the DLAT, BLCES, CIS and ATTL. This shows that the tool is internally consistent and gives correct information on learners' perceptions. The data in Table 2 also reveals that the learners' perceptions about their digital literacy are significantly correlated to their blended learning course experiences ($r=0.46$, $p<0.01$), their interest in the course being done through blended learning approach ($r=0.23$, $p<0.01$) and their attitude towards thinking and learning ($r=0.15$, $p<0.05$).

Table 2: Inter Scale Correlations between Learners Perceptions on Digital Literacy, Course Experience, Course Interest, Attitude Towards Learning and Final Score.

	DLAT	BLCES	CIS	ATTL	FS
Digital Literacy and Access to Technology (DLAT)	1				

Blended Learning Course Experience Survey (BLCES)	0.46 **	1			
Course Interest Survey (CIS)	0.23 **	0.71 **	1		
Attitude Towards Thinking and Learning (ATTL)	0.15 *	0.56 **	0.89 **	1	
Final Score (FS)	0.17 **	0.22 **	0.22 **	0.14 *	1

**Sig at 0.05 Level ** Sig at 0.01 Level*

In the same manner the learners' perceptions about their blended learning course experiences are positive and significantly correlated with their interest in the course being done through blended learning mode ($r=0.71$, $p<0.01$) and their attitude towards thinking and learning ($r=0.56$, $p<0.01$). Similarly, the learners' perceptions about their interest in the course being done through the blended learning approach is positive and significantly correlated with their attitude towards thinking and learning ($r=0.89$, $p<0.01$).

The correlations between the final scores obtained by the students after completing their blended learning course and the four constructs of the survey were also computed. Data presented in Table 2 shows that there are positive and significant correlations between learners' final scores and their digital literacy ($r=0.17$, $p<0.01$), their blended learning course experiences ($r=0.22$, $p<0.01$), their interest in the course being done through blended learning approach ($r=0.22$, $p<0.01$) and their attitude towards thinking and learning ($r=0.14$, $p<0.05$).

Overall, the results show a positive significant relationship between learners' perceptions of digital literacy, course experience, course interest, attitude towards learning and their final scores in a blended course.

Research Question 2

How do learners describe the effectiveness of the Blended Learning environment for their course of study?

There was one open-ended question for the students in the survey. Only English responses were considered for analysis. Aspect-based sentiment analysis was performed on students' views about the blended course, collected from the responses. This was done using 'Meaning Cloud' a sentiment analysis software. For this purpose, first, we trained the model with the data set to perform document-level sentiment analysis, which categorises the sentiments into five levels of polarity: highly positive (P+), positive (P), negative (N), none (NONE) and neutral (NEU). Next, we uploaded the test batch file, and the output was

generated as an .xlsx file with four columns: Polarity, agreement, subjectivity and confidence level.

After that, we trained our model to perform topic-based analysis. For that, we subjected the output to get number of counts for the topics identified by the text analysis.

For a visual representation, from the final output file we selected the topic and sentiment columns and represented these in Figure 1 and Figure 2.

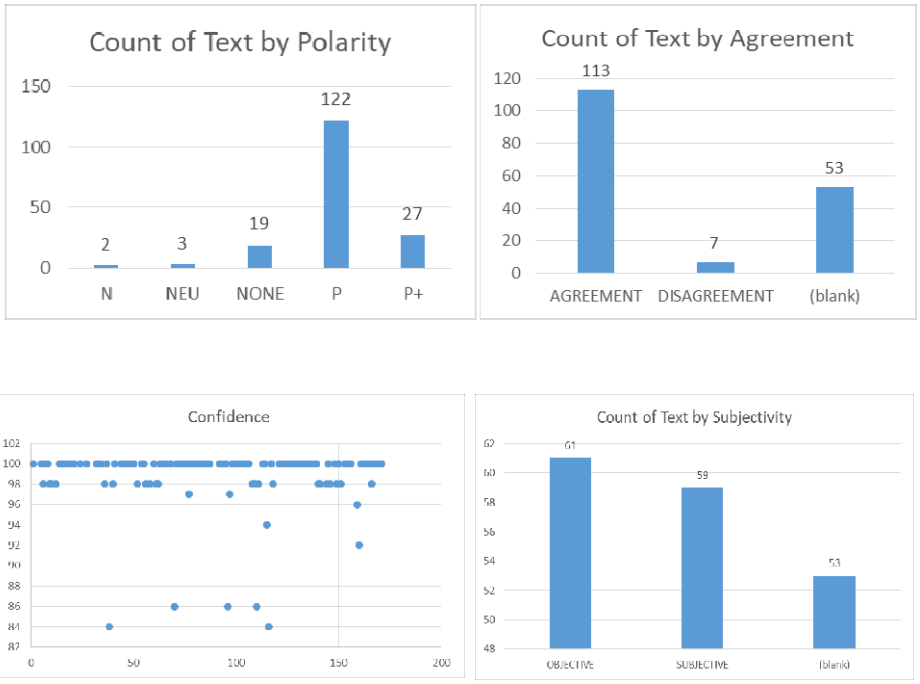


Figure 1. Four Sentiment Columns on Polarity, Agreement, Confidence Level and Subjectivity.

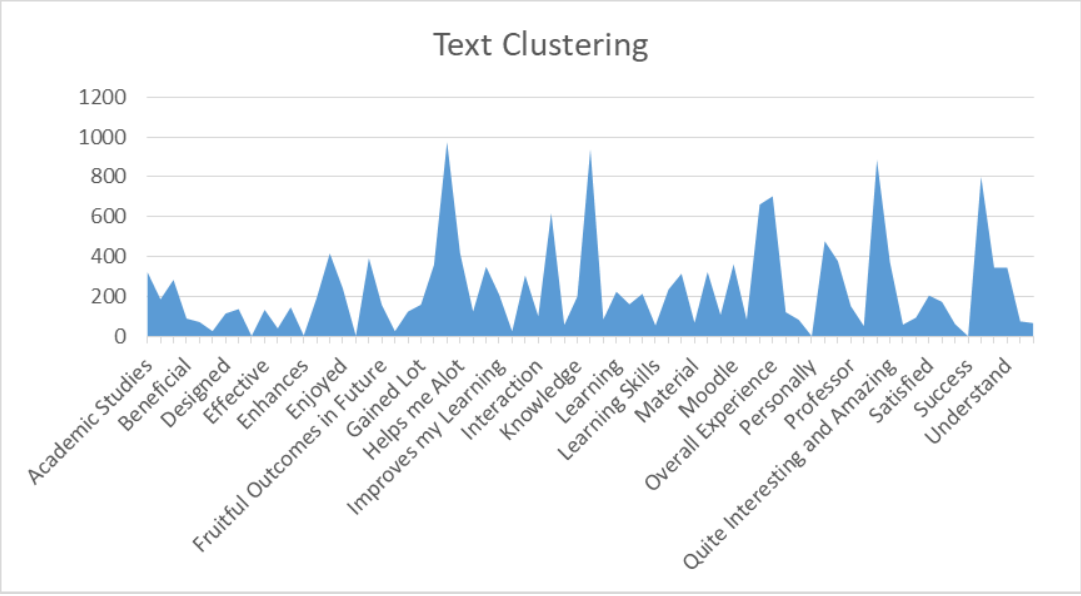


Figure 2. Graphical Representation of Sentiment Based on Text Analysis.

Results from the text analysis in Figure 1 reveals that out of a total of 173 students who had written down their responses to this open-ended question, we see that almost 149 responses were in the highly positive and positive category. Even in terms of agreement and confidence level, the results show that majority of the students agree that learning through blended approach was very helpful and beneficial, and they were confident that they could adopt this approach for learning in future as well.

Data in Figure 2 shows that the best experiences which students revealed in a blended learning environment focussed on gaining knowledge, interesting and meaningful interaction, enhanced engagement and enjoyment, good understanding and being helpful in success. Overall, the students had a positive Moodle experience.

Feedback from the students was also collected during the survey. Majority of the students expressed that blended learning environment gave them a feeling of being safe while studying. Many students expressed that they were able to study on their own time and found it an effective technique. A few of the student responses are given below:

“Blended course enables us to work at our own pace.”
“Blended course provides a safer learning environment. It increases students’ engagement.”
“Blended learning is an efficient method of teaching.”

The survey data also revealed that students found the blended learning approach to be useful and engaging. They liked working in groups and found the activities given by teachers to be interesting. The students expressed that they were able to gain the requisite knowledge and it enhanced their learning experience. Some of the responses given by the students are given below:

“Blended learning courses are very interesting, useful and effective for me”.

“Blended learning was full of knowledge and new learnings. Many new experiences are gained and lots of new things are learned like group work, cooperation, coordination etc.”

“Course was full of information and all the activities were taken care of very well. We can learn at our own pace as all the material was available through the Moodle.”

“First time I've gained experience of studying through blended learning. This course was well constructed for us.”

"It was very informative and knowledgeable. There was space and time for me to do my work at my own leisure. Teacher's motivation and involvement was very helpful. On the whole, it enhanced my learning process."

Results thus show that the students had a positive learning experience through the blended approach and they felt that the sessions were interactive, knowledgeable and they were mostly satisfied with this learning experience. The learners' found the blended learning environment to be effective for their course of study.

Research Question 3

Is there any significant difference in participants' learning performance between blended courses and non-blended courses?

An independent sample t-test was conducted to compare the learning performance of the participants in the non-blended and blended groups. Data in Table 3 shows that there is a difference between the mean scores of the non-blended group (M=69.33, SD=9.60) and the blended group (M=72.31, SD=10.30). This difference is significant in favour of the learning performance of the students in the blended group as the t value is 3.60, which is significant at a 0.01 level of significance. The effect size (Cohen, 1988) of the data was also calculated and the value of Cohen's d =0.30. This shows that there is a small positive effect on the performance of the students. Thus, the result indicates that the participants in the blended mode of learning performed better than the participants in the non-blended mode.

Table 3: Independent samples t-test for the final scores.

Group	N	Mean	SD	t	d
Non-Blended	339	69.33	9.60	3.60**	0.30
Blended	289	72.31	10.30		

**Significant at 0.01 level*

In addition, there was a significant difference between non-blended and blended courses in the students' learning performance in eight out of thirteen courses (see Table 4). For the courses AI, Python and Data Analytics, Cognitive Psychology, Curriculum Studies, Educational Administration, Educational Leadership, Pedagogy of Science, Power Electronics and Retail Management, students in the blended group performed better than in the non-blended group.

Table 4. Independent sample *t*-test for the final scores for different courses.

Course name	Non-Blended	Blended	t-value

	M (SD)	M (SD)	
AI and ML	74.06 (9.32)	77.06 (8.83)	0.99
AI, Python and Data Analytic	76.33 (1.53)	80.00(1.0)	3.48*
Cognitive Psychology	77.84 (9.07)	83.48(9.37)	2.41*
Critical Understanding of ICT in Education	70.55(10.26)	74.55(10.53)	0.90
Curriculum Studies	62.23(9.12)	67.17(9.36)	2.42*
Cyber Security and Data Analytics	79.25(2.5)	82.25(3.3)	1.45
Educational Administration	65.43(6.53)	69.26(7.62)	2.26*
Educational Leadership	65.21(6.01)	70.21(6.45)	3.00*
Educational Management	64.42(6.71)	66.13(7.88)	0.92
Pedagogy of English	72.55(11.34)	75.55(10.52)	0.64
Pedagogy of Science	65.02(11.05)	73.00(11.23)	2.27*
Power Electronics	74.13(5.01)	78.56(4.76)	2.56*
Retail Management	73.17(5.2)	77.92(6.02)	2.07*

**Significant at 0.05 level*

Research Question 4

What impact does a training and mentoring programme have on the facilitators' experience of designing and teaching in a blended learning environment?

An Activity Theory Framework was employed to analyse the in-depth interview data collected from the faculty members who taught using the blended learning approach. Based on the faculty interview results, an activity system was developed (Figure 3). This model represents teachers' perceptions about the professional training they underwent and the outcome of this training. The various elements of the developed activity system are subject, object, tools, rules, community, and division of labour. Subject refers to the participants who underwent the training. Object refers to the purpose of the professional development training initiatives. Tools refer to the MCE-ELMS platform used by the teachers to develop and host their blended course and to other ICT tools. Rules refer to the MIER-TEL policy. In this system, community refers to teacher educators, trainers, MIER top management, technical staff, the Centre for Educational Technology, and others who attempted to make this training programme effective and successful. Division of labour refers to the challenges faculty members faced when implementing BL. Using the Activity Theory framework, triads were developed to analyse the faculty's interview data.

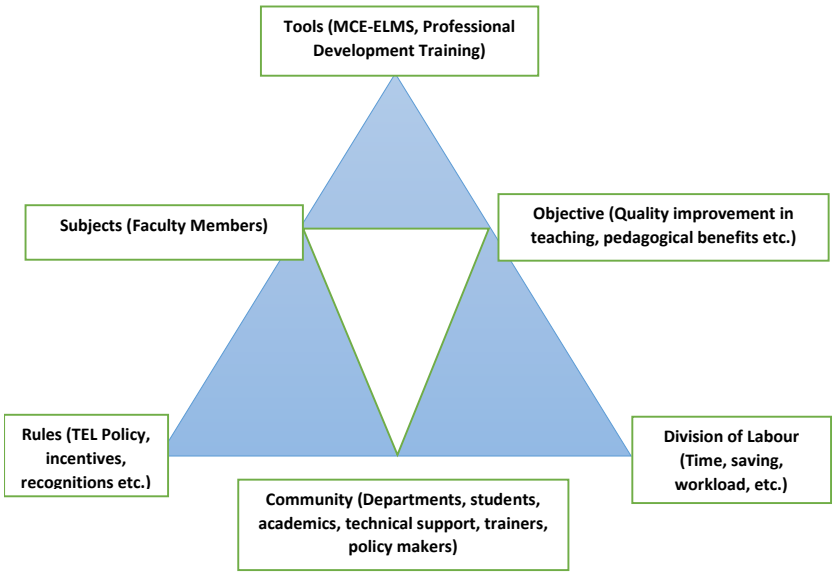


Figure 3. Activity system triangle

Subjects–Tools–Objects

The faculty members expressed a high level of satisfaction with the training provided to them for working on the Moodle platform and for preparing the blended learning courses. The training helped the teachers to use the various features of the MCE-ELMS, which they used for delivering the blended course to the students. All the teachers were new to the platform and were creating blended courses for the first time. One of the teachers said that "The training was so effective that creating our blended courses was not very difficult." Another teacher said that "I was able to develop the requisite skills to upload videos and other open educational resources to my blended learning course." The teachers also mentioned that the training helped them to structure their course properly, create assessments and deliver it in an effective manner.

However, the faculty members also had some concerns. Some of the challenges identified by the faculty were high-speed internet access to students at their residence as many would be hesitant to exhaust their mobile data packs on academic work and lack of motivation without face-to-face interaction. Students can also face issues with time management and complete their coursework independently said some of the faculty members.

Tools–Rules–Division of Labour

The teachers stated that MIER already has a well-established TEL policy developed with the support of COL to support blended learning. The Centre of Educational Technology (CET) provides all the necessary technical support,

access to computer labs, Laptops and requisite software for creating the content for the blended learning courses. Besides, the CET also conducts regular training for the faculty to enhance their skills in creating BL courses. One of the faculty stated, "the support team of the CET is constantly available even after office hours to support them in their endeavour to create BL courses." The faculty also expressed happiness that they were allowed to get their own devices to the college and the CET support staff helped arrange the necessary software for them. Most of the faculty expressed that after they have prepared for the BL course, it saved them time, and there is more free time in their schedule to undertake other activities in the college. However, the courses need to be prepared well in advance and before the start of the semester.

Subject–Community–Objects

In the MIER group of institutions, the training for creating blended learning courses had been done for the first time; hence, some of the faculty members required more training to further hone their skills. Besides, only a few teachers were given training as part of the COL project; other teachers also became interested in creating BL courses. The faculty also wanted that training regarding new features introduced in the LMS platform should be conducted at least once every month to keep themselves abreast with the latest developments. The teachers also expressed that students should also be trained in using the various features of the LMS platform so that they also get used to studying in the BL environment.

Objects–Community–Division of Labour

Most of the faculty members concurred that cooperation is crucial for creating and enhancing the quality of their blended courses. They expressed that there is a need to create a peer review system of the BL Courses so that effective feedback could be provided to them. The faculty also said they would experiment with team teaching as part of their blended learning strategy to improve the effectiveness of the courses. The faculty wanted the CET to collaborate with other like-minded institutions that are using a blended learning approach so that best practices could be shared, and BL courses could be further improved. To assist with such collaboration, COL has now developed a Community of Practice that supports TEL implementation in institutions. MIER faculty can use it to create a sense of community and further the institution's objectives through internal collaboration.

5. Discussion and Conclusions

This study was conducted using a standardised questionnaire i.e., Blended Learning Course Experience Survey (BLCES) prepared by the Commonwealth of Learning in order to support the TEL implementation project in educational institutions. The results of the study suggest that the overall perceptions of the students towards blended learning were very positive. The Chi-square analysis also reveals that there is a significant trend in opinion towards blended learning in the perceptions of students.

This study attempted to answer four research questions. The first investigated if there were any significant relationships between Learners Perceptions on Digital Literacy, Course Experience, Course Interest, Attitude Towards Learning and their final scores in a blended course. The results indicated that there were positive significant correlations between all four constructs of the questionnaire and also with the final scores obtained by the students after completion of their BL course. This shows that the performance of the students shall improve in their BL course if their access to technology and digital literacy skills improves and their interest in the course and their BL experience is enhanced. Besides, their attitude towards thinking and learning shall also help them improve their performance after undergoing a BL course. The results of the present study are similar to the ones conducted by Koneru (2020) and Abeka and Bosire (2020).

Students' responses towards the effectiveness of the Blended Learning environment for their course of study were also evaluated using sentiment analysis to ascertain the second research question. The results show that the majority of the students agreed that learning through a blended approach was very helpful and beneficial, and they were confident that they could adopt this approach for learning in future as well. They also expressed that the BL course made learning more interesting, engaging, enjoyable, interactive, and beneficial. These findings were similar to the ones given in the literature (Wu & Luo (2021); Minhas et al. (2022)). They were able to gain a lot of knowledge, and it helped them to improve their overall performance.

To answer the third research question, a test of the significance of the difference between means was employed. The results showed a significant difference in the learning performance of students who had studied through a blended course compared to those who had studied in a non-blended course. The result was similar to a study conducted by Majeed and Dar (2022).

An Activity Theory Framework was employed to investigate how professional training affected teachers' experience of the blended learning approach. The faculty members expressed a high level of satisfaction with the training provided

to them for working on the Moodle platform and for preparing the blended learning courses. The training helped the teachers to use the various features of the MCE-ELMS, which they used for delivering the blended learning course. The teachers also appreciated the technical support provided to them by the college and access to modern ICT tools, which helped them in enhancing their BL course development skills. The faculty wanted that training regarding new features introduced in the LMS platform should also be conducted at regular intervals. They also said that cooperation and collaboration are crucial for creating and enhancing the quality of their blended courses. Similar findings have been reported by Barbosa (2022) and Ramli et al. (2022)

6. Recommendations

Based on the above findings, the study offers the following recommendations:

1) There is a need to further enhance the competency of the faculty in using the LMS through more training programmes and workshops. The faculty needs to be encouraged to use the Learning Management System as their primary platform so that they are exposed to the pedagogical aspects of TEL, which will give a further boost to blended learning in the institute.
2) The faculty needs to be provided with more exposure to multimedia authoring tools to create more engaging and student-centred content. This would help in further improving the quality of BL courses. The teachers also need to make the material posted in their blended learning course easier to comprehend as reported by the students.
3) Students during the survey reported that some aspects of the Moodle platform were difficult to understand and that it was hard to navigate through the blended course. It is recommended that the students be provided training in using the various features of the LMS platform. This would help in enhancing their ICT skills and encourage them to use the LMS for pursuing BL courses even after college hours.
4) Blended learning courses need to become a part of the curriculum transaction process of the teachers. For this, it is suggested that teachers should identify their courses before the start of each semester and deliver at least one blended learning course in each paper they teach per semester. This should also reflect in their teaching plans which would be circulated to the students at the start of each semester.

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