

Exploring the Challenges and Opportunities of Blended Learning in a Technology–Enabled Education Environment

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Abstract

Technology integration in education has led to blended learning, a pedagogical approach combining traditional face-to-face instruction with online learning components. Through a comprehensive review of existing literature and empirical research, this investigation examines the impact of blended learning on both students and educators. It delves into this approach's diverse range of technologies, including Learning Management Systems, video conferencing tools, and digital content platforms. Through qualitative and quantitative analysis, the research identifies the opportunities that arise from adopting blended learning. It investigates the advantages of increased student flexibility, personalised learning experiences, and enhanced access to educational resources. The study explores how interactive content and virtual collaboration tools can boost student engagement and motivation. However, the study also uncovers educators' and students' challenges when implementing blended learning. These obstacles include technology access and proficiency issues, consistent communication, and addressing individual learning needs. The study addresses potential resistance to change from traditional teaching methods and the importance of teacher training and support. It compares students' achievements in blended learning environments with those in traditional classrooms and analyses the role of technology in influencing these outcomes. Based on the findings, the research concludes by providing insights into the future implications of blended learning in technology-enabled education environments.

Keywords—Blended Learning; Learning Management System; Technology-enabled learning

JETLP Category—Research

Introduction to Blended Learning

Authors (Ruth Colvin Clark, 2016; Thorne, 2003; Mortera-Gutierrez, 2005) define blended learning as a combination of face-to-face instruction and online learning. Students can attend classes in person and access an asynchronous online classroom to complete a series of lesson-based learning activities. (Kintu, 2017) investigated the effectiveness of a blended learning environments by analyzing the relationships between student characteristics, backgrounds, design features, and learning outcomes. (Dziuban, 2018) addressed several outcomes, implications, and possible future directions for blended learning in higher education. (Platonova Raisa I., 2022) aimed to consolidate the recommendations made to higher education research on blended learning. (Cronje) in his paper mentioned that blended learning should be based on learning theory and

refers to a blend of direct instruction and learning by doing. (Duong Huu Tong, 2022) investigated the effectiveness of the flex model of blended learning in mathematics education. (Acosta et al., 2018) considered using blended learning for an in-lab environment to teach Optometry. For effective engagement in Blended Learning, the lesson plan must be prepared appropriately. Table I shows a lesson plan for one module of a course taught by us. Implementing the lesson plan improved the ability of the learner to understand.

Table 1: Blended Learning Lesson Plan for One Module

Session #	Topic	Learning Outcomes	Mode of Teaching / Learning
1	Ice breaking session, Introduction to MATLAB, Basic features	How to start MATLAB	Face to Face
2	Working with variables, workspace	Familiarizing with MATLAB	Self - Paced
3	Controlling the hierarchy of operations	Identify errors and make corrections	Self - Paced
4	Managing workspace	Build and manage workspace	Face to Face
5	Matrix generation	Tabulate matrix and vectors	Self - Paced / Face to Face
6	Matrix operations	Compose sub-matrices	Face to Face
7	Special matrices	Execute operations on matrices	Face to Face

Technology-Enabled Learning

All India Council for Technical Education (AICTE) recommended technology interventions to address the shortage of qualified teachers in colleges. The National Programme on Technology Enhanced Learning (NPTEL), Commonwealth of Learning (COL) came into the picture to deliver quality education through Technology-Enabled Learning (TEL). Advances in technology can be used to increase both the expansion and quality of education. TEL describes the use of technology, platforms, systems, and digital content to expand and enhance student-centered learning. Educational videos have become an important part of education, providing content delivery tools in blended classes. Multiple studies have shown that technology can enhance learning (Means B, 2010; Schmid RF, 2014). Some of the tips suggested by Dr. Michael Smedshammer (faculty instructional design coordinator) in his article “10 tips for creating effective instructional videos” are given in Table 2.

Table 2: Effective Instructional Videos

Tips
1. Keep it short
2. Position the camera above your eyes so you look slightly up at it
3. Look right at the camera lens
4. Smiling helps
5. Avoid overdoing it

Table 3 shows the statistics from YouTube Analytics of an 8-minute instructional video published on YouTube and shared with the learners of the author’s course. The average view duration, with 626 views, is around 1/4th of the instructional video. Similarly, another 30-minute video statistic is shown in Table 4. Its average view duration is around 1/10th of the instructional video. This shows that short videos have more average views, as Table 2 suggests.

Table 3: 8-Minute Recorded Video Analytics

Year-Month	Views	Watch time (hours)	Average view duration
2022-07	10	0.0904	0:00:32
2022-06	52	3.4528	0:03:59
2022-05	7	0.0113	0:00:05
2022-04	3	0.0078	0:00:09
2022-03	47	0.5199	0:00:39
2022-02	260	8.1174	0:01:52
2022-01	247	9.4436	0:02:17
Total	626	21.6433	0:02:04

Table 4: 30-Minute Recorded Video Analytics

Year -Month	Views	Watch time (hours)	Average view duration
2022-10	55	4.0231	0:04:23
2022-11	273	17.778	0:03:54
2022-12	931	50.3294	0:03:14
Total	1259	72.1305	0:03:26

Challenges and Opportunities of Blended Learning

The Learning Management System (LMS) is a crucial tool and a driving force in blended learning. Understanding the adoption of the LMS is a steppingstone to understanding how faculty may choose to adopt technological and pedagogical innovation. Table 5 shows some of the popular LMSs used with descriptions. The reports generated in this paper are from the LMS Moodle used in the author’s institute. Video conferencing tools like Zoom and Google Meet can be integrated with LMS for session tracking and attendance purposes. Through H5P interactive content, learners can be better engaged in online sessions. Table 6 shows some of the merits of blended learning.

Table 5: List of Popular LMSs

Category	LMS	Description
Open Source	Moodle	acronym for “Modular Object Oriented Dynamic Learning Environment.” It is used for blended learning, distance learning and flipped classrooms.

	Sakai	A free, community-driven software platform that supports education, research, and collaboration.
	Canvas	Modern LMS developed and maintained by Instructure Inc.
	blackboard	is a modern, intuitive LMS that uses pedagogical best practices to create flexible and comprehensive online learning experiences.
Proprietary	eCollege	On-demand, software as a service provider of eLearning software owned by Pearson PLC
	HotChalk	Education technology company acquired by Noodle in November, 2020

Table 6: Merits of Blended Learning

Feature	Description
Individualization	Aims to prioritize the needs of an individual learner
Asynchronous Learning	Can provide flexibility in terms of time and place
Cost effective	Learners do not need to travel
Interaction	Learners can use discussion forums eliminating the barriers that might hinder participation, such as fear of talking to others in a physical setting

Blended learning offers an effective approach to education through flexibility, engagement and adaptability, thereby making it a valuable tool in modern education.

Student Performance and Learning Outcomes

According to NEP 2020 document – “assessments of educational approaches in undergraduate education that integrate the humanities and arts with Science, Technology, Engineering and Mathematics (STEM)” have consistently showed positive learning outcomes including increased creativity and innovation, critical thinking and higher-order thinking capabilities, problem-solving abilities, team work, communication skills, more in-depth learning and mastery of curricula across fields, increases on social and moral awareness etc., besides general engagement and enjoyment of learning.

Many college students in STEM fields are conditioned to take a streamlined path through their courses.

- i. A problem to solve is given
- ii. Identify suitable equations
- iii. Substitute known values and arrived at the solutions

In such situations, developing high-level technical and professional skills requires active engagement of activities in the courses taught by faculty. The use of the HTML 5 package (H5P), a free and open-source content collaboration framework based on JavaScript, will help in creating interactive content and help in active engagement of the learner. Fig. 1 shows the usage of regular vs interactive content in a class strength of 42. The numbers indicate how many times the course learners access the content. On average, interactive content is accessed five times more than regular content.

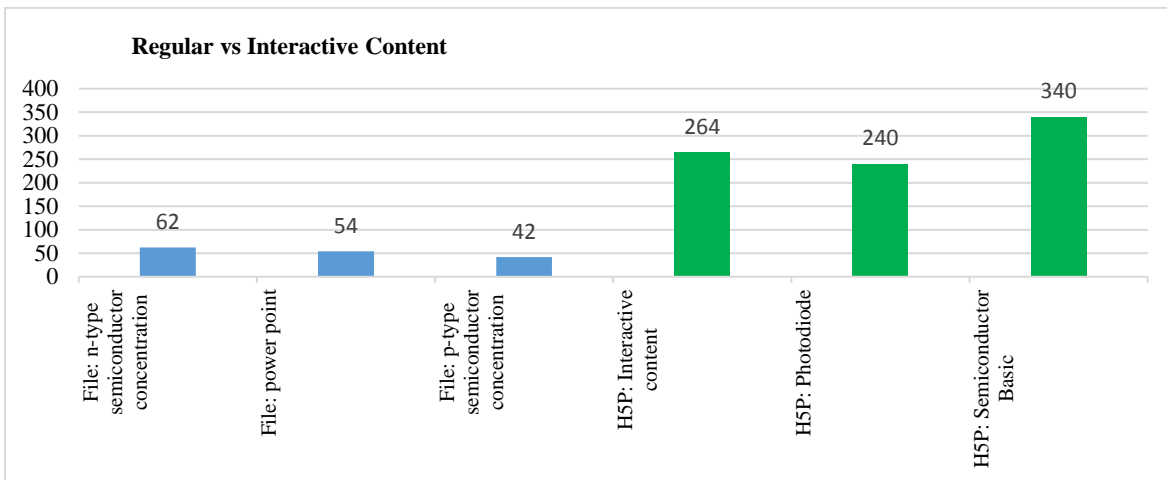


Figure 1: Usage of content - regular vs interactive

To identify how comfortable the learners are in adapting Massive Open Online Courses (MooC), a usage report from the Coursera platform is taken for 6 months (March to August 2021). The Author’s Institute has adopted Coursera Courses for four years to improve student and staff learning. The sample set for Fig.2 includes 79,688 MooC courses taken by engineering students from aerospace (AER), biotechnology, civil engineering, computer science (CSE), electronics communication (ECE), and mechanical engineering. Fig.2 shows that all branches of students preferred *Beginner* difficulty level for Courses. The Y-axis in Fig.2 is represented in a Log with a scaling factor 10 to capture the difference in input values for the AER and CSE branches. The difference is also due to more MooC courses are offered in Computer Science.

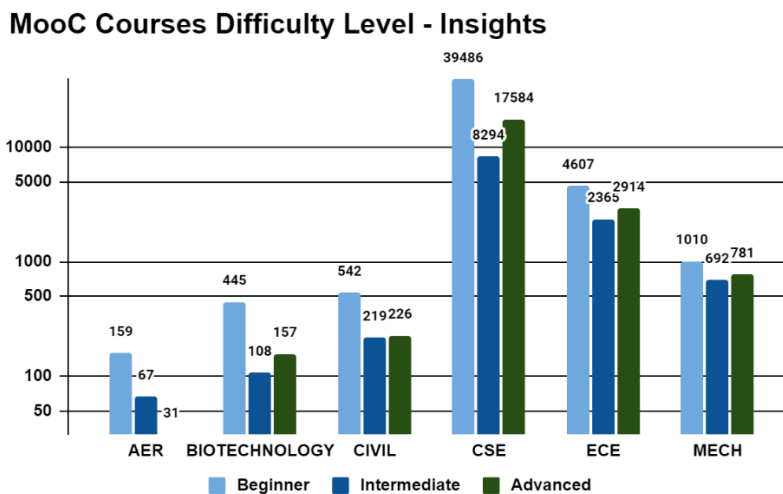


Figure 2: Insights on Learner’s pick of MooC Courses based on difficulty level

Another trend observed from Fig.2 is that learners tend to take *Advanced* difficulty level courses more often than *Intermediate* difficulty level.

TEACHER TRAINING AND SUPPORT

(Lynch, 2005) investigated the rapid and irreversible social changes affecting workplace conditions for educators. Fig. 3 shows a survey conducted on 83 newly joined faculty on the comfort level of using technology-enabled learning. Nearly 88% of the faculty expressed that they are comfortable.

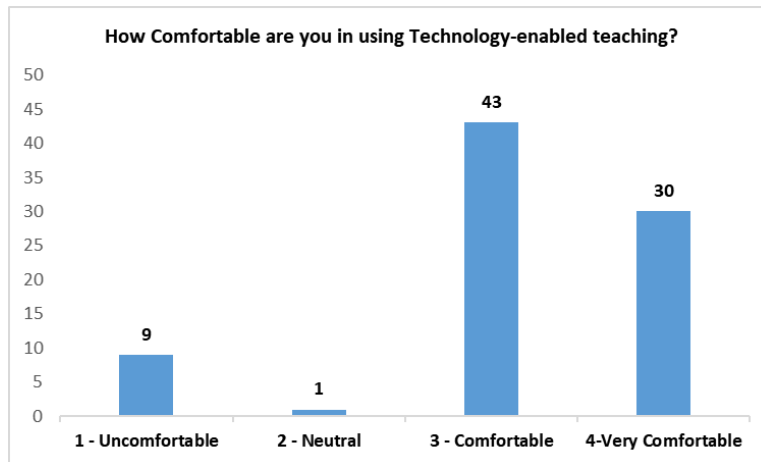


Figure 3: Feedback from 83 newly joined faculty

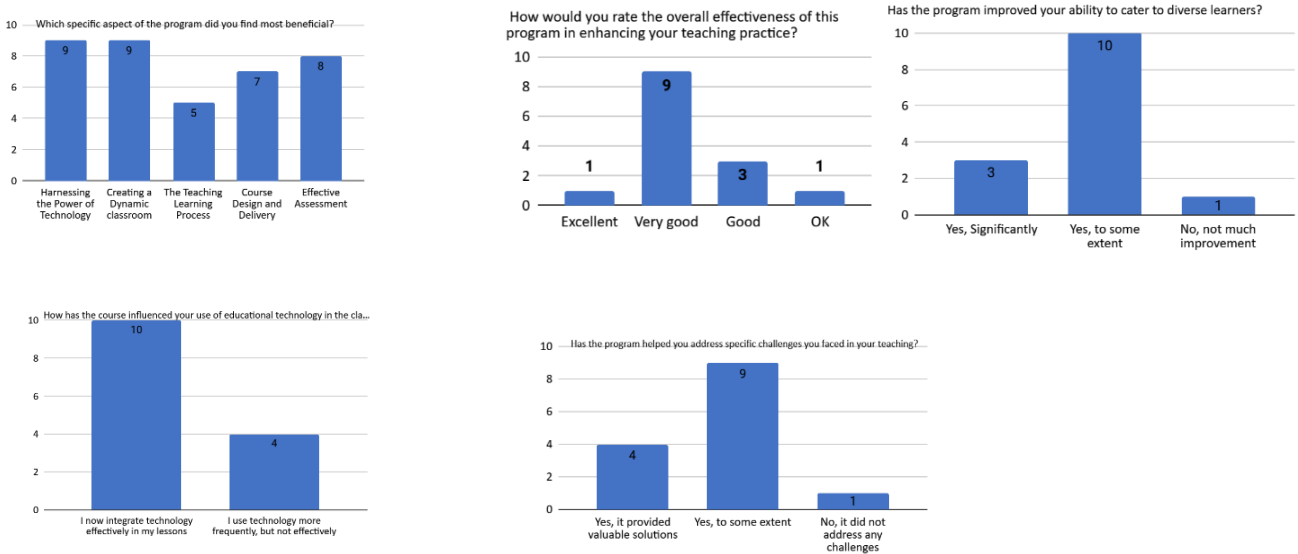


Figure 4: Feedback from faculty

Fig. 4 shows a series of feedback taken from 14 faculty members who have completed IUCEE International Engineering Program.

Both Fig. 3 and Fig. 4 convey that faculty accept the positive role of technology in their teaching and that if properly guided and trained, they can benefit from the same.

Student Engagement and Motivation

Fig. 5. shows how the same students accessed courses taught in regular and blended approaches. The figure shows that students are more engaged when a course is offered in blended mode.

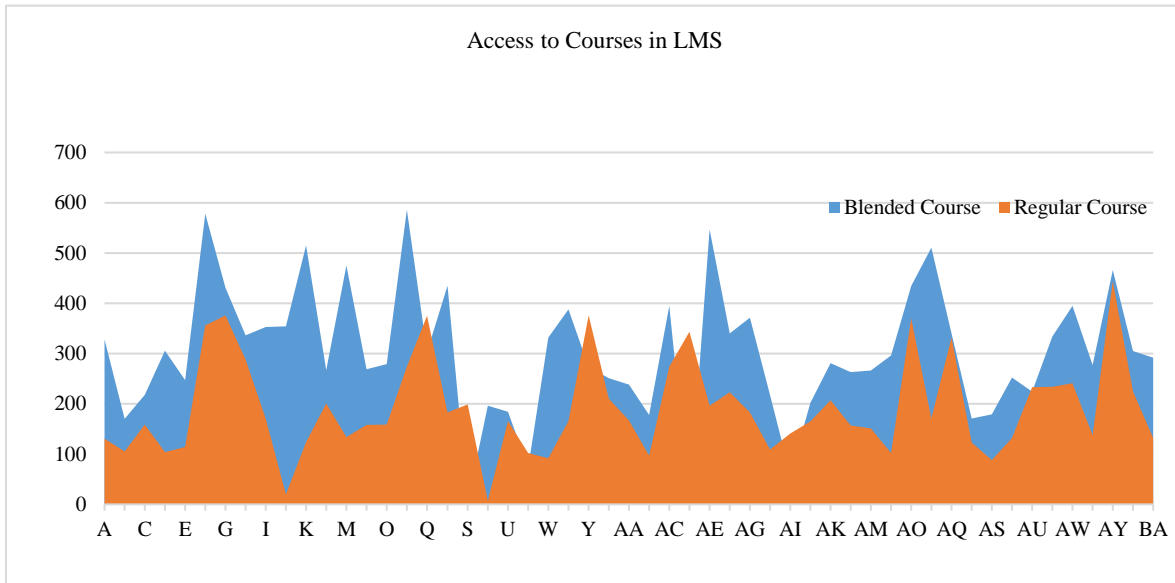


Figure 5: LMS access to courses

Blended learning encourages students to pursue topics that genuinely interest them and provide opportunities for self-directed learning.

Tables 7 and 8 provide a set of questions asked to students and their responses are displayed in Fig. 6 and Fig. 7. It shows that majority of the students are happy with the blended learning methodology.

Table 7: Questionnaire

Mid Semester feedback questionnaire

- A. The course objectives and learning outcomes are clearly specified
- B. The assignments are useful in aiding my learning
- C. The teacher is punctual. S/he begins and ends the class on time
- D. The teacher is prepared and answers questions well
- E. The teacher encourages students to ask questions and to give answers
- F. The teacher provides helpful comments on assignments and tests
- G. The teacher treats students with respect

H. The teacher is available outside of class

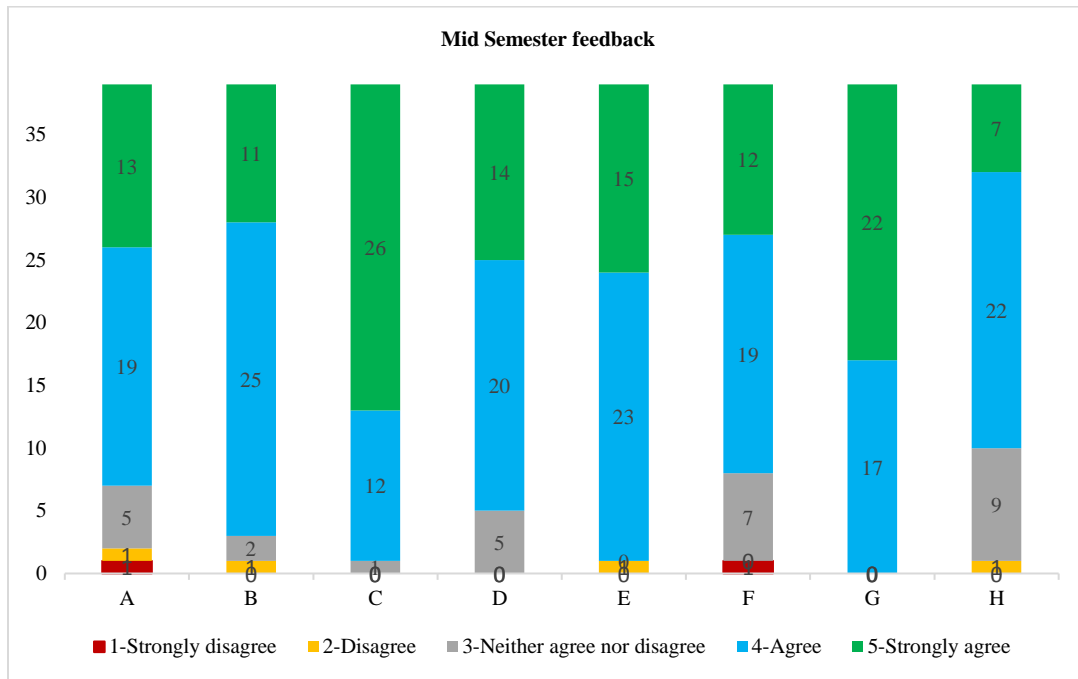


Figure 6: Responses to Semester feedback

Table 8: Questionnaire

End Semester feedback questionnaire

- A. The course is useful and relevant for my learning
- B. The course objectives and learning outcomes are clearly specified and met
- C. The assignments are useful in aiding my learning
- D. The course promotes and encourages critical thinking
- E. The course offers many opportunities to collaborate with peers
- F. The effort required to complete the course is normal
- G. The faculty is effective in aiding my learning
- H. The faculty is punctual. S/he begins and ends the class on time.
- I. The faculty treats students with respect.
- J. The faculty stimulates interest in the material.
- K. The faculty is prepared and answers questions well.
- L. The faculty encourages students to ask questions and to give answers.
- M. The faculty adjusts the pace of class to the students' level of understanding.
- N. The faculty is tolerant of different opinions expressed in class.
- O. The faculty provides helpful comments on papers and exams.
- P. The faculty is available outside of class.
- Q. The Coursera courses are helpful in aiding my learning

R. I understood what is expected of me in preparation and participation for this course

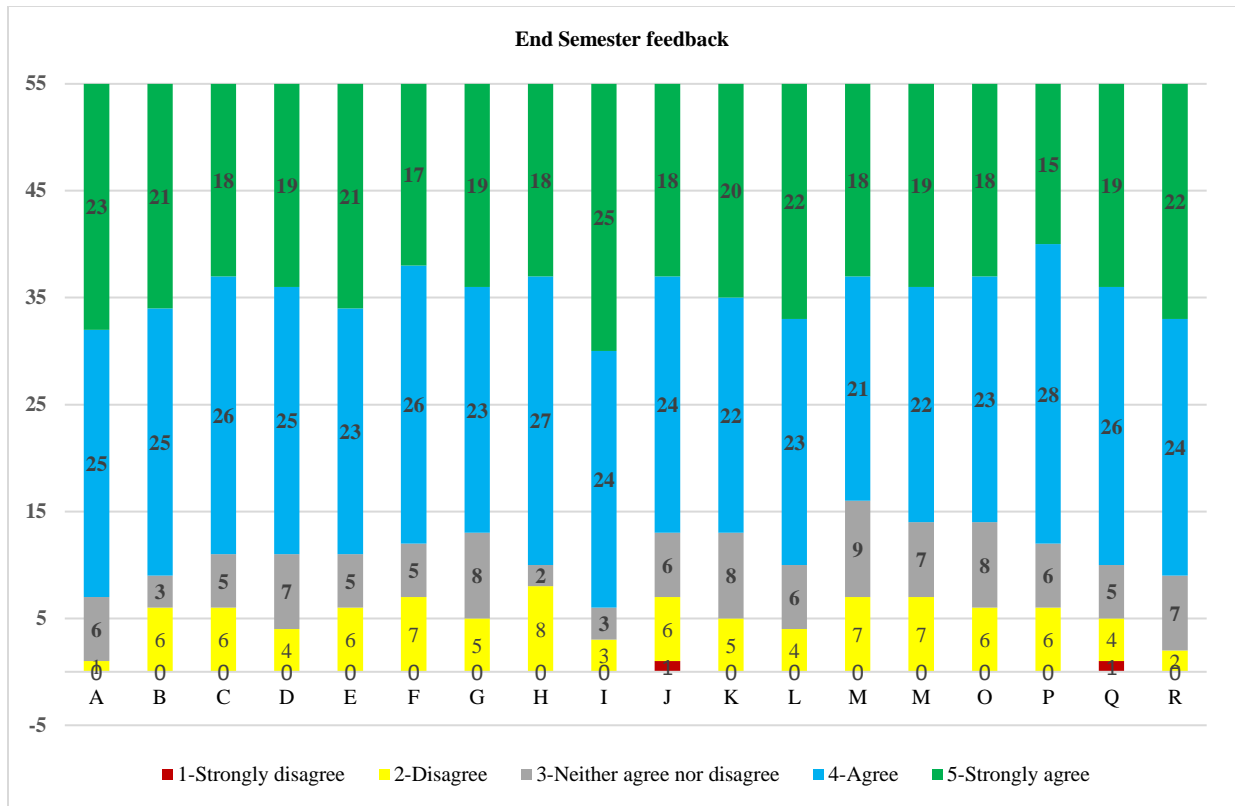


Figure. 7: Responses of End Semester feedback

Conclusion

The Government of India launched its “National Mission on Education through Information and Communication Technology” (NMEICT) in 2009 to provide the opportunity for all the experts and teachers (Mortera-Gutierrez, 2005) in the country to pool their collective wisdom for the benefit of every Indian learner. Technology-enabled learning is a step forward to realize this goal. On the negative side of technology learning, we have surveys and articles (Maalathi, 2023) published on the impact of using smartphones in classrooms. As faculty, one should look at the brighter side of technology-enabled learning and take proper steps to ensure it is effectively delivered.

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