# Technology Enabled Integrated Fusion Teaching for Enhancing Learning Outcomes in Higher Education

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Rajesh Tiwari[1(✉)], Priyanka Agrawal[2], Praveen Singh[1], Shweta Bajaj[3], Vivek Verma[1], Abhishek Singh Chauhan[1]
[1]Department of Management Studies, Graphic Era Deemed to be University, Dehradun, India
[2]PDP Department, Graphic Era Deemed to be University, Dehradun, India
[3]Professional Communication Department, Graphic Era Deemed to be University, Dehradun, India
rajeshtiwari.mgt@geu.ac.in

**Abstract—**Disruptions involving integration of cyber physical systems are changing the industrial ecosystem in the form of industry 4.0. A competent and educated workforce is required to materialise industry 4.0 in India. This study evaluates impact of technology enabled integrated fusion teaching for students in an affiliated college in Delhi NCR region in India. The performance of students taught with technology enabled integrated fusion teaching and traditional method was compared. Paired t test and independent t test was used to analyse the academic performance. It was found that academic performance of students taught by technology enabled integrated fusion teaching (TEIFT) was significantly better than traditional teaching.

**Keywords—**industry 4.0, business students, technology enabled integrated fusion teaching

## 1 Introduction

Industry 4.0 was conceptualised as an outcome of working group in Germany which recommended convergence of information and communication technology to improve competitiveness of manufacturing sector [1]. Whilst the speed of technological change remains high, the speed at which human capital and outturn of skilled labour force can keep up is questionable. This potential lack of qualified workforce will result in slower implementation of transition to industry 4.0 [2]. Education system in developing countries needs to change to adapt to industry 4.0 [3]. There is a need to enhance adoption of technology for educating students for industry 4.0, interdisciplinary knowledge would be required to work in industry have been forced upon workforces, it would be fair to assume that I4 will be gathering increasing pace.

India has the third largest higher education system in the world. National education policy 2020, targets to increase gross enrolment ratio in higher education from 26.35% in 2018 to 50% in 2035 [4]. Driven by western context and pedagogy, it is feared that management education in India is producing barely employable graduates, except

for a few top B-schools [5]. Willingness of leaders is crucial in technology adoption for enhancing outcomes [6] Management education which focuses only on analytical skills lacks focus and ill prepares graduates for employment [7]. The irrelevance of management education is more pronounced in India, and needs a reengineering [8].

## 2 Related work

Faculty prefers pedagogical methodology for students who are less mature and have poor knowledge of the subject. Faculty prefers androgogical methodology for mature students who have certain degree of familiarity with the subject [9]. Satisfaction of technology enabled services enhances continuous usage [10]. Self-financing private colleges under affiliation system gives very liberal internal assessment marks [11] to lure students for admissions in undergraduate level. Similar results were obtained in a study employing interactive technology-based education of healthcare students [12] as innovative pedagogy enhances learning outcomes [13]. Interaction of students and support of teacher affects willingness to continue online learning [14]. Management education should be interactive, global, engage students in experiential learning [15]. Fab-Labs has been used to integrate technology in teaching [16] Flipped classroom could not produce better results than traditional teaching for undergraduate business students [17]. The BSMT methodology was fusion of Socratic method, case analysis and information and communication technology improve critical thinking skills of undergraduate business students [18]. Technology integration and teacher behaviour has a positive association with student engagement [19]. Integration of technology enhanced quality of teaching in the fourth industrial revolution era [20]. Instead of traditional technology infrastructure, virtualization should be used for better results in educational services [21]. Technology driven assessment can optimise the decisions of college teachers in a smart learning environment [22]. Blended learning combined with self-assessment has the potential to enhance autonomy of learners and critical thinking skills [23]. Industry 4.0 in an educational institution has an important role to play in context of society 5.0 as the two are interlinked [24]. Usage of technology enhances the engagement of students [25]. The present study is an attempt to explore a technology enabled integrated fusion model of teaching which combines lecture delivery using pedagogical and androgogical tools with reflection, critical analysis, questioning and assessment.

## 3 Method

The students of undergraduate business progamme, Bachelor of Business Administration (BBA) of an affiliated college located in Delhi national capital region (NCR), affiliated to a state university were selected for the technology enabled integrated fusion teaching and traditional teaching together. The study was done for one year, involving two semesters during August 2021 to July 2022. The students comprised entire

class of 2nd year Bachelor of Business Administration course. The class comprised of 46 students. The students comprised of 39% male and 61% female. The students were taught with technology enabled integrated fusion teaching in one subject and traditional method in other subjects of the 3rd semester. In 2nd Semester they were taught using traditional teaching in all subjects. Paired sample t test, independent sample t test was used to compare the student performance.

**Hypothesis**

H1: There is no significant difference in student performance of traditional teaching and technology enabled integrated fusion teaching in same semester

H2: There is no significant difference in student performance of traditional teaching in previous semester and technology enabled integrated fusion teaching in current semester

### 3.1 The technology enabled integrated fusion teaching

In technology enabled integrated fusion teaching every student has to participate in the daily formative assessment and had no extra time to prepare as the daily assessment was based on lecture delivered using online resources, case studies and real time data of equity markets and economic indicators. Students were allowed to use mobile and laptops during the lecture. The student was allowed to use technology resources to prepare for the assessment.

## 4 Results

To examine the performance of students is same semester, independent sample t test was used to compare marks of student in subject taught with technology enabled integrated fusion teaching approach and average marks of all other subjects taught using traditional method as shown in Table 1 and Figure 1.

**Table 1.** T Test of Marks of Student Performance under TEIFT and Traditional Teaching

| Particulars | N | Mean | Std. Deviation | Std. Error Mean | T Value | Sig. |
|---|---|---|---|---|---|---|
| Performance under TEIFT | 46 | 63.54 | 12.04 | 1.77 | 2.21 | 0.029 |
| Performance under Traditional Teaching | 46 | 58.69 | 8.64 | 1.27 | | |

There was a significant difference ($p<0.05$) between marks of students with technology enabled integrated fusion teaching (Mean:63.54) as compared to average marks (Mean 58.69) of all other subjects in which students were taught with traditional method. First hypothesis is rejected and it is concluded that there is a significant difference in marks of undergraduate business students of an affiliated college taught with traditional method and technology enabled integrated fusion teaching in same semester.

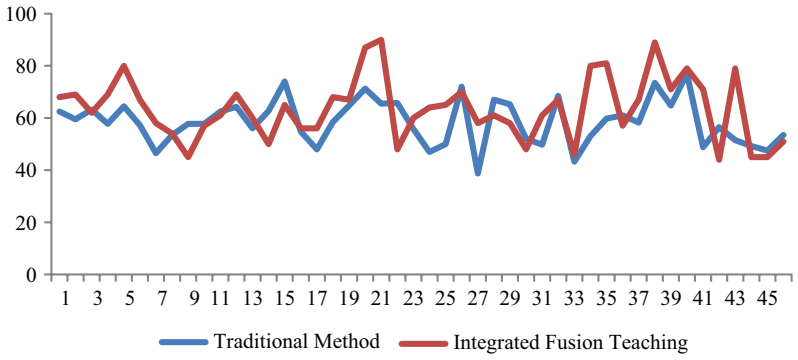


**Fig. 1.** Marks (%) of Students with Traditional Method vs technology enabled integrated fusion teaching in same semester

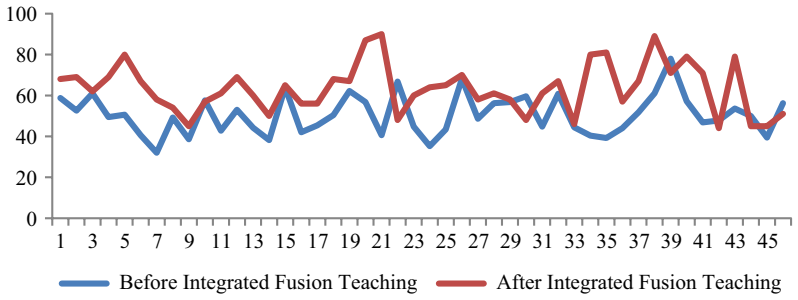


**Fig. 2.** Comparison of Marks (%) before and after technology enabled integrated fusion teaching (TEIFT)

**Table 2.** Paired Sample T Test for Marks before and after Technology Enabled Integrated Fusion Teaching (TEIFT)

| Particulars | Mean | Std. Dev. | Std. Error Mean | Cor. | Mean Diff. | t Value | Sig |
|---|---|---|---|---|---|---|---|
| Student Performance before TEIFT | 63.54 | 12.04 | 1.77 | 0.08 | 15.56 | 5.73 | 0.000 |
| Student Performance after TEIFT | 47.97 | 14.93 | 2.2 | | | | |

Performance of students after technology enabled integrated fusion teaching was significantly higher ($P<0.05$) than traditional teaching. The mean marks after technology enabled integrated fusion teaching was 15.56% (max marks 100) higher than traditional teaching as shown in Table 2 and Figure 2. Traditional teaching was employed in previous semester. Technology enabled integrated fusion teaching was employed in

one subject in current semester. Marks in previous semester represent average marks of all subjects. Thus hypothesis 2 is rejected and it is concluded that there is a significant difference in marks of undergraduate business students of an affiliated college taught with technology enabled integrated fusion teaching (TEIFT) in current semester and traditional method in previous semester.

## 5 Conclusion

The study found a significant difference between marks of undergraduate business students of an affiliated college taught with technology enabled integrated fusion teaching and traditional method in same semester as well as previous semester. Technology enabled integrated fusion teaching provided better outcomes as reflected in marks of students as compared to traditional teaching. There was no significant difference in marks of male and female students in technology enabled integrated fusion teaching. Study found no impact of gender on learning outcomes under traditional and technology enabled integrated fusion teaching. technology enabled integrated fusion teaching provides an opportunity to enhance skills of students in an affiliated undergraduate business school. Indian education system needs to go beyond three-hour exam evaluation to prepare business students for the volatile uncertain complex and ambiguous (VUCA) business environment characterized by rapid disruptions. Technology enabled integrated fusion teaching provides more opportunities for enhancing communication skills and critical thinking skills by facing questions from peers and faculties in an on-the-spot evaluation environment with focus more on analysis rather than memorizing.

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## 7 Authors

**Rajesh Tiwari,** Professor, Department of Management Studies, Graphic Era Deemed to be University, Dehradun, Uttarakhand, India. https://orcid.org/0000-0002-5345-2508

**Priyanka Agrawal,** Assistant Professor, PDP Department, Graphic Era Deemed to be University, Dehradun, Uttarakhand, India. Email: priyankaagrawal.pdp@geu.ac.in, https://orcid.org/0000-0002-5943-4431

**Praveen Singh,** Associate Professor, Department of Management Studies, Graphic Era Deemed to be University, Dehradun, Uttarakhand, India. E-mail: praveensingh@geu.ac.in, https://orcid.org/0000-0001-7208-028X

**Shweta Bajaj,** Assistant Professor, Professional Communication Department, Graphic Era Deemed to be University, Dehradun, Uttarakhand, India. E-mail: shweta-bajaj.comm@geu.ac.in, https://orcid.org/0000-0002-1177-6352

**Vivek Verma,** Assistant Professor, Department of Management Studies, Graphic Era Deemed to be University, Dehradun, Uttarakhand, India. E-mail: vivekverma.mgt@geu.ac.in, https://orcid.org/0000-0002-0406-4322

**Abhishek Singh Chauhan,** Assistant Professor, Department of Management Studies, Graphic Era Deemed to be University, Dehradun, Uttarakhand, India. E-mail: abhishek.singhchauhan@geu.ac.in, https://orcid.org/0000-0003-2828-1206

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