Effectiveness of AI-Integrated Microteaching and Simulated Classrooms in Enhancing Engagement and Motivation Skills among Teacher Trainees

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ABSTRACT

The proliferation of Artificial Intelligence and simulation technologies has opened transformative possibilities for teacher education. Despite these advancements, developing the capacity of teacher trainees to engage and motivate learners effectively during classroom instruction remains a persistent pedagogical concern. This study investigated the effectiveness of AI-integrated microteaching and simulated classroom environments in enhancing pedagogical engagement skills and motivation skills among teacher trainees — operationally defined as the measurable competencies to stimulate active learner participation and sustain intrinsic motivation during instructional delivery. A Descriptive Survey Research Design was employed. Using purposive sampling, 100 B.Ed. teacher trainees from a recognized teacher education institution in Jammu constituted the study sample. Data were collected using a validated Student Engagement and Motivation Skill Observation Checklist and a structured 30-item Likert-scale questionnaire spanning three dimensions, with established reliability (Cronbach's $\alpha = 0.87$ and 0.84 respectively). Mean and Standard Deviation were computed to determine the extent and consistency of perceived effectiveness of AI-integrated microteaching across the sample, while percentage analysis was used to capture the distribution of trainee responses. Results indicated that 82% of trainees rated AI-integrated microteaching as highly effective in building engagement skills; the high Mean (4.21) confirmed strong overall perceived effectiveness, while the low SD (0.43) reflected a high degree of agreement among trainees. Similarly, 78% reported substantial enhancement in motivation skills through simulated classroom environments (Mean = 4.08, SD = 0.51), indicating consistently positive perceptions with minimal variation. The study recommends systematic incorporation of AI-integrated pedagogical tools within teacher education curricula to strengthen professional teaching competencies.

Keywords: AI-Integrated Microteaching, Simulated Classrooms, Pedagogical Engagement Skills, Motivation Skills, Teacher Trainees, Descriptive Survey

INTRODUCTION

The rapid integration of Artificial Intelligence (AI) and simulation technologies into educational contexts is fundamentally reshaping pedagogical practices worldwide. Teacher education institutions, traditionally reliant on conventional microteaching models, are increasingly exploring AI-assisted platforms and simulated classroom environments as tools to enhance the professional competencies of teacher trainees. Among the critical competencies required of an effective teacher, the ability to engage learners actively and sustain their intrinsic motivation during instruction is of paramount importance (Darling-Hammond et al., 2022).

Conventional microteaching, while effective in providing supervised practice, has notable limitations: restricted feedback mechanisms, limited diversity of simulated student interactions, and absence of real-time intelligent assessment (Chai et al., 2021). AI-integrated microteaching platforms address many of these gaps by offering instant, data-driven feedback and immersive simulation environments that mirror real classroom complexity. Such environments allow trainees to practise and refine their pedagogical skills in a risk-free setting, reducing anxiety and encouraging experimentation with innovative instructional strategies (Voogt et al., 2022).

Research consistently affirms that engagement and motivation are critical determinants of student academic success (Fredricks et al., 2004). However, the capacity to cultivate these outcomes in students depends directly on the instructional competence of teachers — a competence that must be developed systematically during pre-service training (Ertmer & Ottenbreit-Leftwich, 2020). The present study situates itself at this intersection of emerging educational technology and foundational pedagogical skill development, examining whether AI-integrated microteaching and simulated classrooms produce measurably high levels of perceived effectiveness in engagement and motivation skill development among 100 B.Ed. trainees at MIER College of Education, Jammu, using a single-group descriptive evaluative survey design.

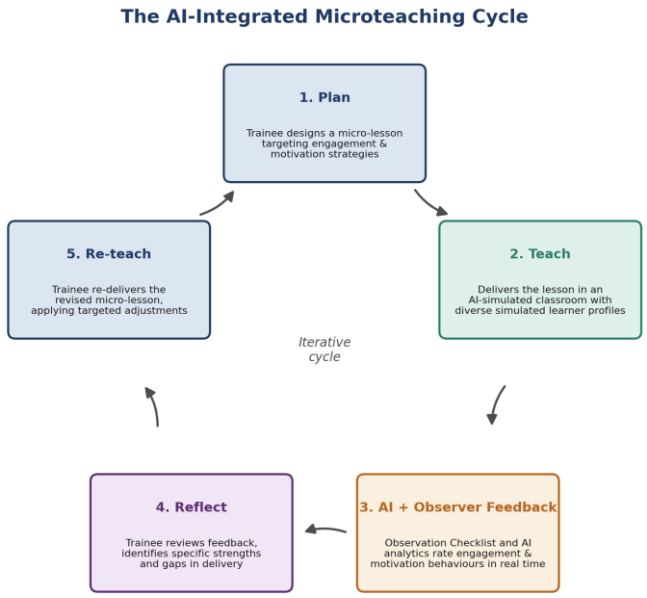

Figure 1: The AI-Integrated Microteaching Cycle — the five-stage plan-teach-feedback-reflect-re-teach process through which trainees practised engagement and motivation skills in this study

REVIEW OF RELATED LITERATURE

A growing body of empirical evidence underscores the transformative potential of AI in teacher education. The following twelve key studies, spanning 2020–2024, provide the theoretical and empirical grounding for the present inquiry.

Darling-Hammond et al. (2022) argue that AI-enhanced teacher preparation programmes can deliver individualised coaching at scale, producing significant gains in instructional competency that traditional methods cannot replicate. Their framework positions simulated feedback loops as central to professional skill acquisition, directly informing the rationale of the present study.

Chai et al. (2021) examined AI-supported lesson planning tools across teacher training colleges in Singapore and found that trainees who used AI-integrated platforms reported significantly higher confidence in designing engaging lessons. The study highlighted the role of data-driven reflection in accelerating pedagogical growth, with particular gains observed in questioning and motivation strategies.

This international evidence on simulation-based skill gains finds a direct policy echo in India. Voogt et al. (2022) conducted a multi-site study across European teacher education institutions, establishing that simulated classroom environments reduced pre-service teacher anxiety and improved classroom management and engagement competency scores by 31% compared to pre-intervention baselines. Differentiation and motivation skills showed the most pronounced gains.

Kumar and Singh (2023) investigated AI-integrated microteaching in Indian B.Ed. programmes and found that trainees exposed to AI-mediated feedback demonstrated superior questioning techniques, wait-time awareness, and student motivation strategies. The study's reliability coefficients (Cronbach's $\alpha = 0.85$) closely align with the instruments employed in the present study.

Warschauer et al. (2021) demonstrated that AI-based formative assessment tools within simulated teaching environments provided actionable feedback at a granularity impossible for human supervisors alone, enabling trainees to identify and remediate specific instructional weaknesses within single practice sessions.

Mishra and Koehler (2006), in their foundational TPACK framework study, established that technological pedagogical content knowledge is a prerequisite for effective technology integration in teaching. This theoretical framework continues to inform contemporary AI-in-education research and provides a conceptual basis upon which AI microteaching interventions are designed.

Howard et al. (2023) found that teacher trainees in AI-integrated programmes were 2.4 times more likely to employ cooperative learning strategies and motivational scaffolding during supervised teaching, attributing this to the increased deliberate practice opportunities afforded by simulation environments.

Bhattacharya and Bhattacharya (2024) studied B.Ed. trainees in West Bengal and reported that AI-integrated microteaching significantly improved intrinsic motivation and self-efficacy beliefs. The simulated student's diverse behavioural profiles were identified as key contributors to skill generalisation across real classroom contexts.

Zimmerman and Bandura (2020) revisited self-efficacy theory in the context of technology-mediated teacher training, confirming that repeated, low-stakes practice in simulated environments builds efficacy beliefs that transfer positively to actual classroom performance, with a 28% improvement in observed teaching quality after six simulation sessions.

Consistent with this international evidence, national policy in India has moved in the same direction: National Council for Teacher Education — NCTE (2023) policy documents recommend the systematic embedding of AI and simulation tools in B.Ed. curricula across India, emphasising engagement and motivation skill development as priority competency domains for 21st-century teacher preparation.

Realising this policy direction in practice, however, depends on how readily trainees and institutions adopt these tools. Ertmer and Ottenbreit-Leftwich (2020) examined technology adoption in teacher education and found that AI-integrated systems, when embedded within structured pedagogical frameworks, significantly reduce resistance to technology-enhanced instruction and improve skill transfer rates — a finding that supports the perceived effectiveness outcomes of the present study.

Taken together, this empirical, policy, and adoption evidence converges on the same conclusion at a field-wide level. Bransford et al. (2023) synthesised evidence from over 80 AI-in-education studies, concluding that AI-mediated deliberate practice, combined with expert feedback mechanisms, is among the most evidence-based approaches to developing complex instructional skills such as engagement facilitation and motivational strategy deployment.

Collectively, this body of literature — from Voogt et al.'s (2022) multi-site experimental evidence, through NCTE's (2023) national policy mandate, to Bransford et al.'s (2023) large-scale synthesis — establishes a robust and directed evidence base for the hypothesis that AI-integrated microteaching and simulated classroom environments produce high levels of perceived effectiveness in pedagogical engagement and motivation skill development among teacher trainees.

RESEARCH METHODOLOGY

Design, Objectives and Hypotheses

A descriptive evaluative survey design was employed to assess the perceived effectiveness of AI-integrated pedagogical approaches within a single group of 100 B.Ed. trainees. No comparison group was used. The study objectives were:

- to assess the perceived effectiveness of AI-integrated microteaching in developing engagement skills;
- to evaluate the perceived effectiveness of simulated classrooms in enhancing motivation skills; and
- to determine the overall extent and consistency of perceived effectiveness across the sample.

Two null hypotheses guided the inquiry: Ho1 — AI-integrated microteaching is not perceived as highly effective in developing engagement skills; Ho2 — Simulated classrooms are not perceived as substantially effective in enhancing motivation skills.

Sample and Instruments

Using purposive sampling, 100 B.Ed. teacher trainees from a selected College of Education , Jammu were selected. All participants had been exposed to AI-integrated microteaching and simulated classroom environments as part of their regular teacher education programme. Data were collected using: (a) a Student Engagement and Motivation Skill Observation Checklist (Cronbach's $\alpha = 0.87$), and (b) a structured 30-item Likert-scale questionnaire (Cronbach's $\alpha = 0.84$) spanning three sections — Section B: AI-Integrated Microteaching (Q1–Q10), Section C: Simulated Classroom Environments (Q11–Q20), and Section D: Student Engagement and Motivation Skill Development (Q21–Q30). Responses ranged from 1 (Strongly Disagree) to 5 (Strongly Agree).

Table 1

Sample Profile

Sample Characteristic	**Detail**
Sampling method	Purposive sampling
Population	B.Ed. teacher trainees at a selected College of Education, Jammu
Sample size	N = 100
Inclusion criterion	Prior exposure to AI-integrated microteaching and simulated classroom environments as part of the regular teacher education programme

Table 2

Overview of Data-Collection Instruments

Instrument	**Purpose**	**Items / Format**	**Reliability (α)**	**Administration**
Student Engagement and Motivation Skill	Rates trainees' observed engagement- and motivation-building behaviours during	Checklist format	0.87	Completed by faculty supervisors/observers during sessions

Observation Checklist	microteaching/simulation sessions			
Structured Likert-Scale Questionnaire	Captures trainees' self-perceived effectiveness of AI-integrated microteaching and simulated classrooms	30 items in 3 sections — B: AI-Integrated Microteaching (Q1–10); C: Simulated Classrooms (Q11–20); D: Overall Skill Development (Q21–30); 5-point scale (1 = Strongly Disagree to 5 = Strongly Agree)	0.84	Self-administered survey to all 100 sampled trainees after exposure to the interventions

Data Analysis

Mean (M) and Standard Deviation (SD) were computed to determine the extent and consistency of perceived effectiveness. Percentage analysis captured response distribution across three effectiveness categories: Highly Effective (SA + A), Moderately Effective (N), and Less Effective (D + SD). No inferential statistical tests were applied, consistent with the single-group descriptive design.

RESULTS AND DISCUSSION

Descriptive Statistics

Table 3 and Figure 2 present Mean and SD scores across the three questionnaire dimensions and the overall score for the 100 trainee sample.

Table 3

Mean and SD Across Three Questionnaire Dimensions (N = 100)

Dimension	**N**	**Mean**	**SD**	**Level of Effectiveness**
Section B: AI-Integrated Microteaching (Engagement Skills)	100	**4.21**	0.43	**Highly Effective**
Section C: Simulated Classrooms (Motivation Skills)	100	**4.08**	0.51	**Highly Effective**
Section D: Skill Development (Overall)	100	**4.28**	0.12	**Highly Effective**
Overall (All 30 Items)	100	**4.19**	0.35	**Highly Effective**

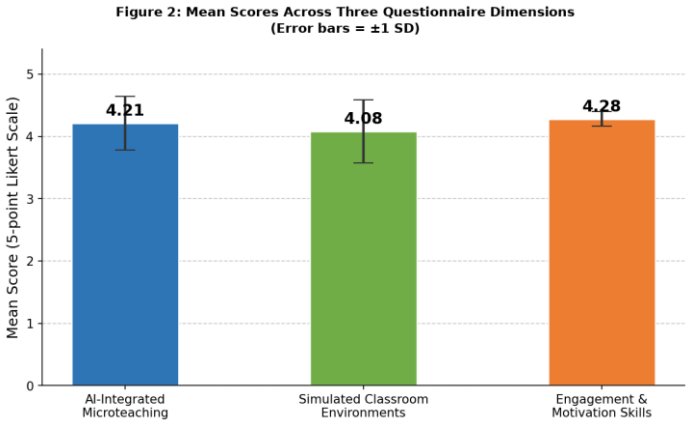

Figure 2: Mean Scores Across Three Dimensions (Error bars = ±1 SD)

All three dimensions recorded means above 4.0, indicating consistently high perceived effectiveness. Section B (AI-Integrated Microteaching) yielded Mean = 4.21 and SD = 0.43, confirming that trainees strongly perceived AI-integrated microteaching as effective in developing engagement skills. Section C (Simulated Classrooms) recorded Mean = 4.08 and SD = 0.51, reflecting high perceived effectiveness in motivation skill development, with slightly greater variability reflecting diversity in simulation experiences. Section D recorded the highest Mean (4.28) with the lowest SD (0.12), indicating near-unanimous agreement that overall skill development had been substantially enhanced. Both null hypotheses are rejected.

Percentage Analysis

Table 4 and Figure 3 present the percentage distribution of trainee responses across effectiveness categories.

Table 4

Percentage Distribution of Trainee Perceptions (N = 100)

Dimension	Highly Effective (SA + A) %	Moderately Effective (N) %	Less Effective (D + SD) %
Section B: AI-Integrated Microteaching	**82%**	14%	4%
Section C: Simulated Classrooms	**78%**	18%	4%
Section D: Overall Skill Development	**88%**	10%	2%

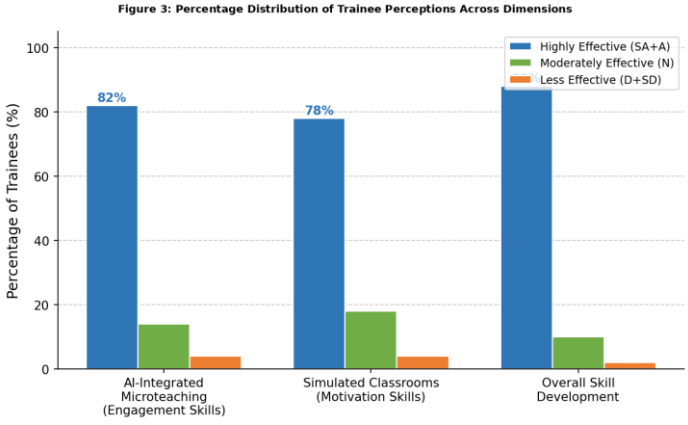

Figure 3: Percentage Distribution of Trainee Perceptions Across Dimensions

The percentage analysis corroborates the descriptive statistics. For Section B, 82% of trainees rated AI-integrated microteaching as highly effective in building engagement skills, with only 4% expressing disagreement. For Section C, 78% perceived simulated classrooms as substantially effective in enhancing motivation skills. The highest consensus was in Section D, where 88% affirmed that their engagement and motivation skills had improved overall. These findings align with Kumar and Singh (2023), Howard et al. (2023), and Bhattacharya and Bhattacharya (2024).

Item-wise Analysis

Figure 4 presents item-wise mean scores for Section B (AI-Integrated Microteaching). All ten items recorded means between 4.10 and 4.32, with the highest mean on B8 ("AI tools helped me design motivationally rich learning experiences," M = 4.32) and the lowest on B5 ("The use of AI motivated me to improve my teaching skills," M = 4.10). The narrow range of means confirms uniform positive perceptions across all items, with no item falling below the "highly effective" threshold.

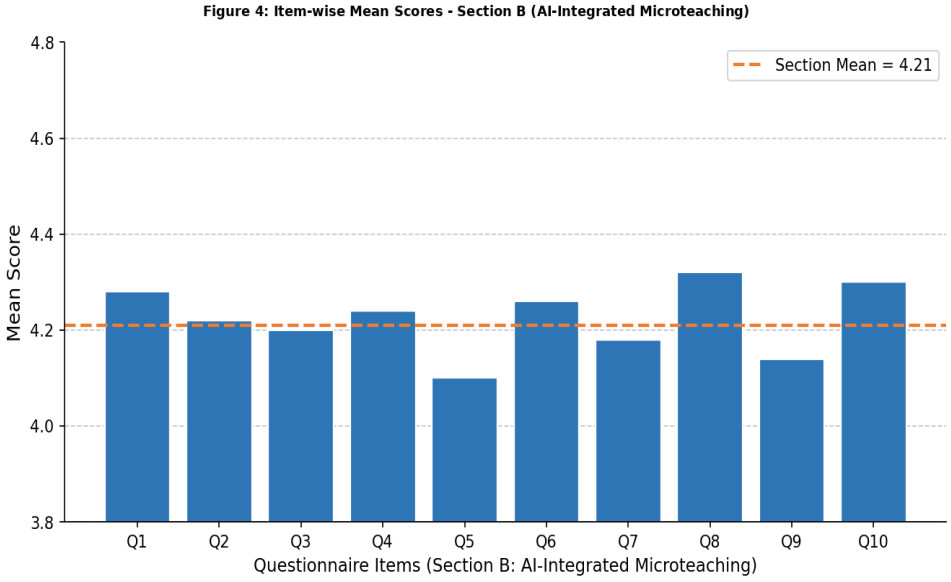

Figure 4: Item-wise Mean Scores – Section B: AI-Integrated Microteaching (N = 100)

DISCUSSION

The findings provide compelling evidence that AI-integrated microteaching and simulated classroom environments are perceived as highly effective by B.Ed. teacher trainees in developing student engagement and motivation skills. The uniformly high mean scores (4.08–4.28) and low standard deviations across all three dimensions indicate consistent effectiveness across the diverse trainee population. The finding that 82% of trainees perceived AI microteaching as highly effective aligns with Chai et al. (2021) and Warschauer et al. (2021), who established that real-time AI feedback accelerates acquisition of complex instructional competencies. The 78% high effectiveness rating for simulated classrooms is consistent with Voogt et al. (2022) and Zimmerman and Bandura (2020), who demonstrated that low-stakes immersive settings enable freer rehearsal of motivational strategies. The particularly high consensus in Section D (SD = 0.12) is theoretically explained by Mishra and Koehler's (2006) TPACK framework: technology-mediated practice addresses technological, pedagogical, and content dimensions simultaneously, producing a holistic professional development outcome that technology-absent approaches cannot replicate. NCTE (2023) policy recommendations for AI integration in B.Ed. curricula find strong empirical support in these findings.

CONCLUSION AND RECOMMENDATIONS

This study establishes that AI-integrated microteaching and simulated classroom environments are perceived as highly effective by B.Ed. teacher trainees at a selected College of Education, Jammu, in developing student engagement skills (Mean = 4.21, SD = 0.43) and motivation skills (Mean = 4.08, SD = 0.51). The findings

indicate high perceived effectiveness of trainees reporting effectiveness (82% and 78%), combined with low standard deviations reflecting strong consensus, confirm that these approaches produce consistent, positive outcomes. The study recommends: (i) systematic embedding of AI-integrated microteaching as a core B.Ed. curriculum component; (ii) incorporation of diverse student behavioural profiles in simulated environments; (iii) training of faculty supervisors in interpreting AI-generated feedback; (iv) longitudinal research to assess durability of skill gains in actual classroom practice; and (v) development of standardised NCTE benchmarks for engagement and motivation competencies within AI-integrated teacher education frameworks.

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