

PAPER

The Digital Learning Edge: Quality MOOCs and IT Employee Productivity

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ABSTRACT

This study investigates the influence of massive open online courses (MOOCs) on employee performance in the information technology (IT) sector, focusing on the quality of MOOCs as defined by trainer-centred and learner-centred approaches. Utilising a structured questionnaire distributed to 400 IT professionals and analysed through structural equation modelling (SEM), the study finds that both dimensions of MOOC quality positively impact employee performance behavioural and result-based. The number of MOOCs completed demonstrates a stronger positive association with employee performance, particularly among those who have completed more than three courses. The findings provide useful guidance for designing corporate learning strategies in IT sectors and add to the growing research on how digital learning improves workplace performance for employees.

KEYWORDS

massive open online courses (MOOCs), structural equation modelling (SEM), information technology (IT)

1 INTRODUCTION

The demand for continuous professional development has significantly increased in the dynamic and competitive landscape of the information technology (IT) sector. One of the most transformative tools to emerge in the domain of professional learning is the massive open online course (MOOC). MOOCs offer flexibility, scalability, and cost-effectiveness, making them an attractive learning alternative for both individuals and organisations. While MOOCs have revolutionised access to education, their effectiveness in enhancing workplace performance remains a critical area of investigation. MOOCs offer important advantages for businesses, as various approaches can be implemented to modify the MOOCs model to align with the organisation's learning and training goals [1]. The swift growth of open educational resources, both virtual technology-enabled teaching and learning platforms, and MOOCs, are considered modern trends in education [2]. This study specifically explores the impact

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of MOOC quality on employee performance within the IT sector. Two dimensions of MOOC quality, trainer-centred and learner-centred, form the basis for evaluating their influence. Trainer-centred MOOCs are structured around instructor-led teaching with fixed content delivery, whereas learner-centred MOOCs prioritise interactivity, self-direction, and practical engagement. Employee performance is examined through behavioural outcomes (like improved motivation and organizational alignment) and result-based outcomes (like promotions and productivity gains). Moreover, the role of learner commitment, operationalized through course completion rate (CCR), is considered a moderating factor. CCR distinguishes between low (1–3 courses completed) and high (>3 courses completed) engagement levels. By incorporating CCR, this study seeks to understand whether quality MOOC participation amplifies the impact of course quality on workplace performance. The key objective of the research is to explore the impact of the quality of MOOCs on employee's performance in the IT sector. The outcomes of this research will offer practical implications for HR managers, corporate trainers, and MOOC providers to better design and align learning interventions with organisational competency needs.

2 LITERATURE REVIEW

Massive open online courses have transformed professional development by providing scalable, affordable, and flexible learning environments. Initially designed for open education, MOOCs have increasingly found a place in corporate training, particularly in the IT sector, where rapid technological advancements require constant upskilling [3]. Their ability to deliver both foundational and cutting-edge content to large and diverse audiences makes them ideal for organisations seeking to build a future-ready workforce [4].

The effectiveness of MOOCs largely depends on their quality, which includes instructional design, content relevance, and learner engagement. These qualities are often categorised into two approaches: trainer-centred and learner-centred [5]. Trainer-centred MOOCs focus on structured delivery, instructor control, and pre-defined learning paths. These courses typically offer comprehensive lectures, clearly stated objectives, and tightly aligned assessments [6]. They appeal to learners who prefer a guided experience and benefit from expert-driven content. Learner-centred MOOCs emphasise flexibility, autonomy, and active learning. They feature project-based tasks, peer interaction, and self-paced modules, fostering a deeper understanding and stronger engagement [7]. Such courses are particularly valuable for adult learners in dynamic professional settings like IT [8]. MOOCs have shown promise in building employee competencies essential for career advancement. Dillahunt et al. (2014) noted that MOOCs provide access to in-demand technical skills and allow learners to tailor learning to personal goals [9]. In the IT sector, where skill relevance directly affects employability, MOOCs serve as both remedial and aspirational tools [10]. Competency development in MOOCs is often analysed using Kirkpatrick's four-level evaluation model: reaction, learning, behaviour, and results. While earlier levels relate to course quality and learning gains, behavioural and result-based changes determine the actual impact in the workplace [11]. Employee performance, measured through behavioural and result-based indicators, can be influenced significantly by MOOC participation. Behavioural performance refers to changes in motivation, teamwork, and proactive problem-solving. Result-based performance includes tangible outcomes like promotions, pay raises, and improved productivity. High-quality MOOCs, especially learner-centred ones, encourage intrinsic

motivation, leading to long-term behavioural improvements [12]. Trainer-centred MOOCs, with their structured nature, often produce measurable results, particularly when aligned with job functions and performance metrics [9].

Furthermore, MOOCs can act as alternative credentialing systems, providing certifications that enhance credibility and influence promotions and salary negotiations [13]. CCR is a crucial factor in determining the real impact of MOOCs. While MOOCs are open to all, completion is rare; often less than 10% of enrollees finish a course [14]. However, those who do complete MOOCs tend to be more motivated, disciplined, and capable of applying their knowledge at work [9]. In this study, CCR is classified as low (1–3 courses) and high (>3 courses). High completers generally experience greater performance gains due to consistent exposure and deeper engagement with course content [15]. CCR thus moderates the relationship between MOOC quality and employee performance, intensifying the impact when learning is sustained [16]. Although MOOCs have been widely studied, few works specifically examine how trainer- and learner-centred quality dimensions affect both behavioural and result-based performance within the Indian IT sector [17]. Moreover, the moderating role of course completion rate remains underexplored in applied organisational contexts. This study addresses these gaps through a structured model using Smart PLS-based structural equation modelling.

3 RESEARCH METHODOLOGY

This study employs a quantitative, cross-sectional research design to explore the influence of MOOC quality on employee performance. The structural relationship between independent (MOOC Quality) and dependent (employee performance) variables is assessed using SEM. The target population comprises IT sector employees who have completed at least one MOOC relevant to their professional roles. Using purposive sampling, a total of 400 valid responses were collected from employees across diverse roles (developers, testers, security analysts, etc.) and experience levels. A purposive sampling approach was adopted to ensure that participants had enrolled in MOOCs courses and completed at least one MOOCs and have work experience in the IT sector and have exposure to self- or employer-funded MOOC platforms. A structured questionnaire was designed using 5-point Likert scale items, validated through a pilot study for reliability (Cronbach's $\alpha > 0.70$) and construct validity. The questionnaire is divided into three parts where part one includes Demographic and participation details. The second part includes MOOC quality includes trainer-centred quality (six items) and learner-centred quality (four items). And the third part includes employee performance includes behavioural performance (five items) and result-based performance (five items). The course completion rate was captured in two categories which are low completion which ranges between one to three MOOCs completed and high completion means completion of three MOOCs courses. This variable moderates the relationship between MOOC quality and employee performance. SEM statistical technique was used for analysis.

Research hypotheses

- H_a1:** Trainer-centred MOOCs significantly influence behavioural performance of employees.
- H_a2:** Trainer-centred MOOCs significantly influence result-oriented performance of employees.

- H_a3:** Learner-centred MOOCs significantly influence behavioural performance of employees.
- H_a4:** Learner-centred MOOCs significantly influence result-oriented performance of employees.
- H_a5:** CCR significantly moderates between learner-centred MOOCs and employee performance _ behaviour
- H_a6:** CCR significantly moderates between learner-centred MOOCs and employee performance _ results.
- H_a7:** CCR significantly moderates between trainer-centred MOOCs and employee performance _ behaviour
- H_a8:** CCR significantly moderates between trainer-centred MOOCs and employee performance _ results.

3.1 Data analysis

The paper has applied descriptive statistics where the demographics of 400 IT sector employees who have participated in MOOC course. The data provides insights into IT employees’ demographics and their engagement with MOOCs. Most participants are aged between 25 and 30 years, with a majority being male. The dominant roles include full-stack, back-end, and front-end developers. Most employees have 1–3 years of experience, and a strong majority (87.5%) believe in regular learning. Over half have completed 1–3 MOOC courses, while 42.5% have completed more. Funding for these courses is fairly balanced between self-funded, company-funded, and shared. Technical courses are the most popular type of MOOC attended, followed by management and general courses. Figure 1 shows the SQM where the assessment of the measurement model, validity analysis–convergent validity, outer loadings and average variance extracted (AVE) is given.

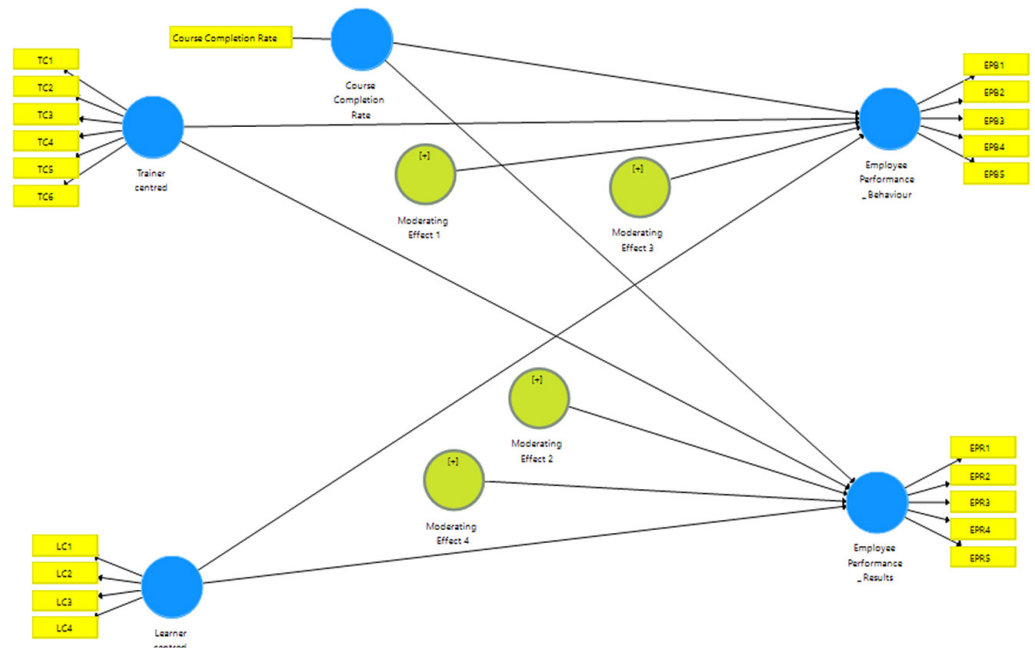


Fig. 1. SQM-assessment of measurement model

The convergent validity analysis presented in the study demonstrates strong indicator reliability and internal consistency for all constructs involved in the model. All measurement items for the constructs. Employee performance (behavioural and result-based), learner-centred MOOCs, and Trainer-centred MOOCs have statistically significant loadings ($p < 0.001$), with values mostly above the recommended threshold of 0.7. Notably, items like EPR2 (loading = 0.931, $T = 165.241$) and EPB4 (loading = 0.912, $T = 10.413$) indicate robust measurement reliability. Although a few trainer-centred items (e.g., TC1, TC2, TC4) had slightly lower loadings (but above 0.4), they were retained based on satisfactory AVE, Cronbach’s alpha, and composite reliability. This confirms that the measurement model reliably captures the latent constructs and supports the structural model used to assess the impact of MOOC quality on employee performance in the IT sector.

All outer loadings except of **TC1 ← Trainer centred, TC2 ← Trainer centred and TC4 ← Trainer centred**. AVE, Composite Reliability, and Cronbach’s alpha of **TC1 ← Trainer centred, TC2 ← Trainer centred and TC4 ← Trainer centred** met the threshold limits, and outer loadings of **TC1 ← Trainer centred, TC2 ← Trainer centred and TC4 ← Trainer centred** were more than 0.40. Therefore, F1, G1, G2, and I1 were retained. Table 1 shows the AVE and Figure 2 shows the trend of average variance extracted.

Table 1. Average variance extracted

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
Employee Performance Behaviour	0.792	0.772	0.082	9.720	0.000
Employee Performance Results	0.854	0.854	0.008	105.437	0.000
Learner centred	0.682	0.682	0.017	39.606	0.000
Trainer centred	0.587	0.585	0.016	37.437	0.000

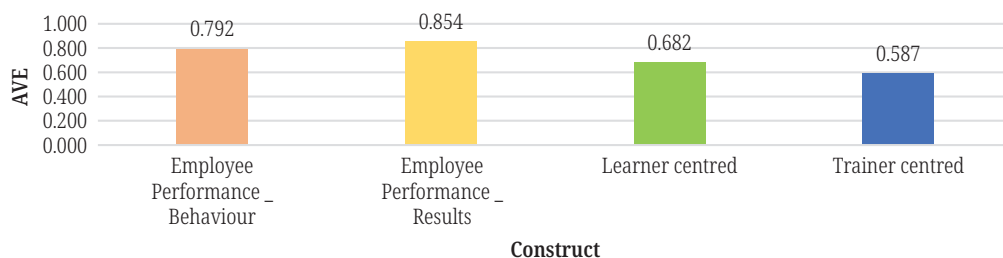


Fig. 2. Average variance extracted

All AVE’s are greater than 0.50. Thus, with ‘a’ and ‘b’ above, convergent validity is established.

Discriminant validity was assessed using both the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio. According to the Fornell-Larcker table, each construct’s AVE square root (diagonal values) is greater than its correlations with other constructs (off-diagonal values), confirming that each construct is distinct from the others. For example, the square root of AVE for employee performance – behaviour is 0.890, which is higher than its correlation with other constructs like trainer centred (0.076) or learner centred (0.050). Similarly, all HTMT values are below the

0.95 threshold, indicating there is no multicollinearity or overlap among constructs. This confirms that the model achieves strong discriminant (divergent) validity.

The composite reliability (Rho A) values for all constructs exceed the acceptable threshold of 0.70, confirming good internal consistency. Employee performance – behaviour and employee performance – Results both show very high Rho A values (0.958), suggesting highly reliable measurement. Learner-Centred MOOCs and Trainer-Centred MOOCs also show reliable values of 0.860 and 0.884, respectively. All p-values (except one, which is marginal) are significant, further validating the consistency of the constructs used in the structural model.

The indicator reliability was evaluated by squaring the outer loadings of each item. Most items had squared loadings above the acceptable threshold of 0.50, indicating that each item explained more than 50% of the variance of its corresponding construct. However, three trainer-centred items (TC1, TC2, and TC4) had squared loadings slightly below 0.50. Despite this, these items were retained because the overall construct met thresholds for AVE, Cronbach's alpha, and Rho_A. Hence, indicator reliability is largely established for the model.

Cronbach's alpha values for all constructs exceeded 0.70, confirming internal consistency reliability. Specifically, *Employee Performance – Behaviour* ($\alpha = 0.935$) and *Employee Performance – Results* ($\alpha = 0.957$) demonstrated excellent reliability. Similarly, *Learner-Centred* ($\alpha = 0.842$) and *Trainer-Centred* ($\alpha = 0.855$) also showed strong internal consistency. Thus, the items within each construct reliably measure the same underlying concept.

The variance inflation factor (VIF) values for all items were below the critical value of 5, indicating no issues of multicollinearity. This suggests that independent variables in the model are not excessively correlated with each other, and therefore, the path coefficients can be interpreted with confidence. The absence of multicollinearity strengthens the reliability of the structural model.

All path coefficients in the structural model were found to be statistically significant ($p < 0.001$), confirming the study's key hypotheses. *Trainer-Centred MOOCs* had a very strong influence on result-based employee performance ($\beta = 0.994$), while also significantly impacting behavioural outcomes ($\beta = 0.719$). *Learner-Centred MOOCs* also positively influenced both behaviour ($\beta = 0.846$) and results ($\beta = 0.772$). These findings validate that both MOOC types significantly improve employee performance, with trainer-centred MOOCs showing the strongest effect on measurable outcomes.

The R^2 values for the dependent variables – *Employee Performance: Behaviour* (0.710) and *Employee Performance: Results* (0.682) – indicate that the structural model explains a substantial portion of variance in these constructs. Since both values exceed the threshold of 0.67, the model demonstrates strong explanatory power, meaning the quality of MOOCs (both learner- and trainer-centred) effectively explains employee performance in the IT sector.

The effect sizes (f^2) range between 0.201 and 0.314 for all paths, which fall within the range of moderate effect (0.15 to 0.35). Specifically, *Trainer-centred MOOCs* → *Employee Performance (Results)* shows the highest effect (0.314), confirming its practical significance in driving result-based performance outcomes. This suggests that both types of MOOC quality meaningfully contribute to performance, with a slightly stronger influence from trainer-centred learning for measurable workplace outcomes.

To assess predictive relevance, the model employed PLS Predict using 10-fold cross-validation. While the Q^2 values for behavioural performance indicators were slightly negative, all values for result-based indicators were positive and above 0, indicating acceptable predictive capability. The mean absolute error (MAE) values

from PLS-SEM were consistently lower than those from the linear model (LM), and all differences were negative. This confirms that the model has good out-of-sample predictive power, especially for result-based employee performance.

The moderation analysis shows that CCR significantly strengthens the relationship between both types of MOOCs (learner-centred and trainer-centred) and both performance outcomes (behavioural and result-based).

- For learner-centred MOOCs, the effect on *behavioural performance* is stronger when CCR is high ($\beta = 0.716$ at +1 SD), and similarly for *result-based performance* ($\beta = 0.775$ at +1 SD).
- For trainer-centred MOOCs, the effect on *behavioural performance* increases significantly with high CCR ($\beta = 0.946$ at +1 SD), and even the result-based impact is amplified ($\beta = 0.763$ at +1 SD).

All moderation effects are statistically significant ($p < 0.001$), supporting hypotheses Ha5 to Ha8. This confirms that employees who complete more MOOCs experience greater performance benefits, highlighting the importance of sustained engagement with quality digital learning.

The model is statistically strong, practically meaningful, and predictively reliable. It reveals that both trainer- and learner-centred MOOCs positively influence employee performance, with stronger effects observed when employees complete more courses. This reinforces the value of quality MOOCs in upskilling IT professionals and improving workplace outcomes. The dataset link and questionnaire for the current study can be referred in the given link: https://docs.google.com/document/d/1qitLhfolvCKFABfWGqtLVYc8d5_52Ukp/edit#heading=h.ftioym23zq8i

3.2 Ethical statement

This study was conducted as per the ethical guidelines for academic studies. The participation of all the people in giving their information was voluntary. No personal identifiable information was collected, and the data has maintained the anonymity and was used solely for academic research purposes. The authors declare that there are no conflicts of interest or privacy issues related to this study.

4 RESULTS

The evaluation of results in this study was grounded in SEM using SmartPLS, which enabled both the measurement and structural models to be rigorously assessed. The findings strongly support the research hypotheses (Ha1 to Ha8), demonstrating the effectiveness of both trainer-centred and learner-centred MOOCs in enhancing employee performance in the IT sector. Hypotheses Ha1 to Ha4 were verified through the significant path coefficients between the independent variables (MOOC types) and the dependent variables (employee performance behavioural and result-based). For example, the path coefficient from trainer-centred MOOCs to result-based performance, was particularly strong ($\beta = 0.994$, $p < 0.001$), signifying a robust influence of structured, instructor-led learning on tangible workplace outcomes like productivity and promotions. Similarly, learner-centred MOOCs showed a notable impact on behavioural performance ($\beta = 0.846$, $p < 0.001$), highlighting the value of self-directed, interactive learning environments in fostering soft skills

such as motivation, collaboration, and critical thinking. Figure 3 shows the results of employee behaviour.

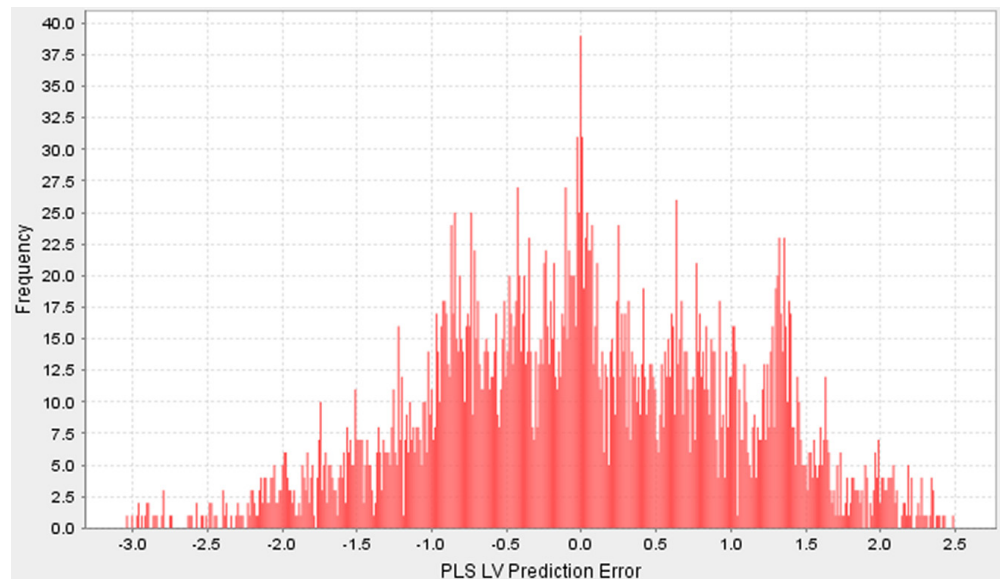


Fig. 3. Employee performance behaviour

To verify hypotheses Ha5 to Ha8, moderation analysis was performed using CCR as a moderating variable. The results revealed that when employees completed more than three MOOCs (high CCR), the positive effect of both trainer- and learner-centred MOOCs on performance was significantly amplified. This moderation was statistically significant across all four relationships, confirming the role of sustained learning engagement in maximizing the benefits of MOOCs. The statistical robustness of the model was further validated through R² values (0.710 for behavioural performance and 0.682 for result-based performance), indicating that the model explains a substantial portion of variance in employee outcomes. Figure 4 shows the results of employee performance.

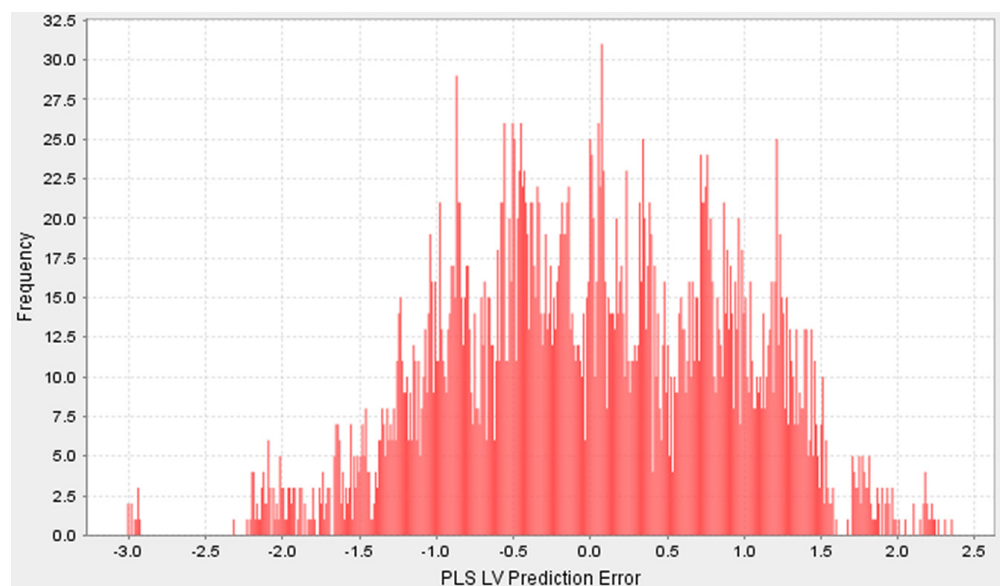


Fig. 4. Employee performance results

Trainer-centred MOOCs have a statistically significant and strong impact on both behavioural ($\beta = 0.719$, $p < 0.001$) and result-based performance ($\beta = 0.994$, $p < 0.001$). These structured, instructor-led courses appear particularly effective in driving tangible outcomes like promotions, performance appraisals, and productivity. Learner-centred MOOCs also demonstrate a significant effect on behavioural performance ($\beta = 0.846$, $p < 0.001$) and result-orientated performance ($\beta = 0.772$, $p < 0.001$). These courses foster greater autonomy, critical thinking, and engagement, contributing to improved decision-making, collaboration, and motivation. Moderation by CCR confirms that the impact of both trainer- and learner-centred MOOCs is significantly enhanced when learners complete more than three courses. All moderating paths (Ha5 to Ha8) are statistically significant, confirming the robustness of CCR as a moderating variable. Model performance indicators further support the findings: R^2 values of 0.710 (behavioural) and 0.682 (results) suggest substantial explanatory power. All f^2 values fall between 0.2 and 0.3, indicating moderate effect sizes. Q^2 values and negative prediction errors demonstrate strong predictive validity.

Additionally, effect size (f^2) calculations, ranging from 0.201 to 0.314, indicated moderate but meaningful influence of the predictors on performance variables. The Q^2 predictive relevance values were also positive for most indicators, and prediction errors (MAE) from PLS-SEM were consistently lower than those from the linear model, confirming strong out-of-sample predictive power. Together, these results confirm the validity, reliability, and practical significance of the structural model, thereby fully supporting all eight research hypotheses and highlighting the strategic value of high-quality MOOCs in corporate learning for IT professionals.

5 DISCUSSION

HR and training managers can leverage both trainer- and learner-centred MOOCs depending on performance objectives. Trainer-led courses can be integrated into formal development plans targeting promotions and technical mastery. MOOC providers should optimise course designs by integrating both structured content and learner-driven elements to maximise engagement and impact. Organisations should support employees through funding and incentives, especially for those willing to complete more than three MOOCs, to harness maximum performance benefits. Employees should strategically select MOOCs that align with their roles and performance goals, with a focus on sustained participation and completion. The study focuses solely on the Indian IT sector, and results may differ in other industries or geographic contexts. The performance measures are based on employee self-assessments, which may introduce response bias. The longitudinal studies could provide better insights into how MOOCs participation affects performance over time. For future research, other moderating variables such as learning motivation, course quality ratings, or organisational culture can be explored. A comparative study across sectors or international contexts may enhance the robustness of findings.

6 CONCLUSION

The study concludes that the quality of MOOCs whether trainer-centred or learner-centred has a significant positive impact on both behavioural and result-oriented performance of employees in the IT sector. Furthermore, the CCR plays a crucial moderating role, amplifying these effects among highly engaged learners. These insights

underscore the importance of sustained, high-quality digital learning strategies for individual and organisational development in tech-driven workplaces.

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