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Toward a Synergistic Model of Outcome-Based Education and Deep Learning: Addressing Alignment Gaps, Teacher Training, and Assessment Practices

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ABSTRACT

Purpose of the Study: This study aims to develop a synergistic model integrating Outcome-Based Education (OBE) and deep learning in higher education to address persistent challenges in curriculum alignment, teacher readiness, and assessment practices. The research examines the interrelationships among Course Learning Outcomes (CLOs), Program Learning Outcomes (PLOs), teacher pedagogical competencies, and assessment models to formulate a comprehensive framework that enhances instructional quality and student learning outcomes. **Methodology:** This research employs a Systematic Literature Review (SLR) in accordance with the PRISMA protocol. Data were collected from Scopus and Web of Science-indexed scholarly articles published between 2015 and 2025, supplemented by seminal theoretical works. From an initial pool, 47 eligible studies were selected and thematically analyzed using open and axial coding to identify integration patterns across the curriculum design, teacher training, and assessment dimensions. **Main Findings:** Three critical dimensions emerged as foundational for successful OBE-deep learning integration: first, alignment between CLOs and PLOs requires a quantitative mapping matrix supported by Content Beyond the Syllabus initiatives; second, teacher training must prioritize generative pedagogical strategies and assessment literacy; third, a dynamic assessment model integrating process, summative, social, and value-added evaluations is essential. The synergistic model extends Biggs's constructive alignment by incorporating adaptive personalization and continuous feedback dimensions, which are enabled by digital technology. **Novelty/Originality of this Study:** This study presents a comprehensive, synergistic model that integrates OBE and deep learning paradigms into a unified framework, addressing integration gaps that have been previously unexplored in the literature. It extends constructive alignment theory by incorporating adaptive personalization and technology-enabled continuous feedback loops, and synthesizes evidence from recent international publications to provide a theoretical foundation for future empirical research in higher education curriculum reform.

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A. Introduction

Higher education in the twenty-first century is better characterized as undergoing a transformation increasingly shaped by an input-oriented paradigm shift towards outcome-oriented higher education systems. You build it around enabling graduate students to demonstrate graduation outcomes, which has become the favoured framework for designing curricula, shaping instructional activities, and assessing student progress (Harden, 2002, 2007; Harden et al., 1999). Meanwhile, deep learning, the meaningful and integrative engagement with knowledge that leads to long-term retention of key concepts, critical thinking, and transfer competencies, continues to be underscored by contemporary educational research as the learning approach we should aim for (Biggs, 1996; Biggs et al., 2001). The convergence of these two agendas is no longer simply a pedagogical preference but a strategic necessity, as accreditation bodies, industry stakeholders, and global frameworks such as the United Nations Sustainable Development Goal 4 demand demonstrable evidence of measurable, competency-based, and relevant student learning.

Despite this convergence, both empirical and conceptual literature show that OBE and deep learning are understood and operationalized very differently (Muzakir et al., 2025; Muzakir & Susanto, 2023; Pangestu et al., 2025). It has been observed that the implementation of OBE prioritizes outcome mapping and assessment compliance over the important pedagogical conditions for meaningful learning (Pang et al., 2009; Wang et al., 2011). On the other hand, work on deep learning has mainly been directed toward individual students and motivational processes (Ames, 1992; Deci & Ryan, 2000; Trigwell, 2005) without a concrete framing of that engagement within accomplishment-oriented structural systems. Ultimately, this frequently leads to a disconnect between what institutions profess will be outcomes and what students experience.

Recent studies have identified three common problem domains that hinder synergistic integration. Secondly, alignment gaps between Course Learning Outcomes(CLOs) and Program Learning Outcomes(PLOs) continue to compromise curriculum coherence, particularly in engineering, language, and professional education programs (Choudhari et al., 2026; Haritha et al., 2024; Rajak et al., 2026). Secondly, teacher capacity and preparedness are still poorly developed, with teachers losing control of learning activity as they try to design outcome-oriented but learner-focused teaching practices (Felder & Brent, 2003; Pulungan et al., 2024). Third, assessment practices in the OBE milieu are still oriented towards a summative technical compliance rather than for holistic formative and value-added assessments when it comes to capturing deep learning (Arun Kumar, 2020; Pradeesh et al., 2025).

Whereas these individual domains have been extensively studied, relatively less work has attempted to integrate them into a unified framework. Nowhere have the three silos of alignment, faculty development, and assessment been addressed as dependent rather than independent (Felder & Brent, 2003; Frenk et al., 2010) dimensions that are common to most existing OBE models rooted in medical or engineering education traditions. In addition, while constructive alignment theory (Biggs, 1996) represents a strong link between assessment practice and the deep learning approach; assessment practice and its relationship with the deep learning approach have largely been matters of description rather than systematic study. New developments in tracking digital and AI-based personalized learning (Pradeesh et al., 2025) contribute to another argument that the constructive alignment paradigm must go beyond traditional pedagogies targeted on discrete content delivery systems for collaborative adaptive learning ecosystems.

The literature reveals a clear evidence gap: there is no integrative, holistic model that measures alignment, teacher training, and assessment as a single, synergistic system to drive deep learning within an outcome-based education (OBE) framework. This study is novel in that it proposes such a model based on a systematic synthesis of recent Scopus-indexed evidence and an enhanced theoretical extension of constructive alignment. In doing so, it builds on previous investigations by shifting from independent implementation studies to a broader, integrative framework suited to current higher education administration.

Hence, this study attempts to achieve 4 specific goals. Initially, it traces the persistent themes of alignment gaps cited in international OBE research published in Scopus-indexed scientific journals. Secondly, it pinpoints the aspects of teacher training necessary to operationalize deep learning in the lifelong context under OBE. Third, it investigates newly emerging assessment practices and their alignment with deep learning theory. Fourth, a synergy model of these three dimensions is proposed to create conditions under which deep learning could thrive most effectively at the OBE system level. This research uses the institutional and programmatic implementation of OBE in higher education as its unit of analysis, drawing on global and Indonesian contexts.

This paper presents the thesis that (i) OBE and deep learning are not strictly parallel paradigms, but, rather, mutually constitutive ones whose integration is dependent on three interdependent levers: alignment architecture, teacher capacity, and dynamic assessment. When these levers work in a vacuum, OBE may devolve into a compliance-driven instrument; when they work synergistically, OBE becomes a generative infrastructure for real-world learning. A systematic literature review will be used to analyse this argument.

The rest of the article is organized as follows. The following section describes the systematic literature review method in accordance with the PRISMA-based protocol and analytical procedures. The findings are presented in the results section across three thematic, dimensional categories, with a discussion of their interpretation and how they align with existing educational theory, culminating in a synergistic model. The conclusion summarizes contributions, implications for educational management, and paths for future research.

B. Methods

This study employed a Systematic Literature Review (SLR) approach following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol. The SLR methodology was selected because the research aims to develop a conceptual integrative model derived from a structured synthesis of high-quality empirical and theoretical literature, rather than to test a hypothesis through primary data collection. Through SLR, the study minimizes selection bias and enhances transparency, replicability, and analytical rigor in identifying patterns across the literature on Outcome-Based Education (OBE), constructive alignment, deep learning, teacher training, and assessment practices.

The literature search was conducted in two primary databases, Scopus and Web of Science, supplemented by selected sources from peer-reviewed open repositories indexed in Sinta and DOAJ for contextual comparison. The search strategy combined three keyword clusters connected by Boolean operators: (a) outcome-based education OR OBE OR outcome-based teaching and learning, (b) deep learning approach OR constructive alignment OR meaningful learning, and (c) curriculum alignment OR teacher training OR assessment practices OR CO-PO mapping. The time frame was set from 2015 to 2025 to capture the most recent decade of scholarship, with the inclusion of seminal foundational works published earlier (Biggs, 1996; Deci & Ryan, 2000; Harden et al., 1999) when these were essential to the theoretical scaffolding.

Inclusion criteria comprised: (a) peer-reviewed journal articles, conference proceedings, and book chapters indexed in Scopus or Web of Science; (b) studies addressing OBE, constructive alignment, deep learning, teacher capacity in OBE settings, or assessment design in OBE; (c) studies conducted at the higher education level; and (d) full-text accessible in English or Bahasa Indonesia. Exclusion criteria included non-peer-reviewed sources, editorials without substantive empirical or theoretical contributions, duplicate publications, and articles addressing primary or secondary school contexts exclusively, unrelated to higher education reform. After title and abstract screening, full-text reading, and quality appraisal using a modified Critical Appraisal Skills Programme (CASP) checklist, forty-seven articles were retained for in-depth analysis.

Data extraction was conducted using a structured matrix containing the following fields: bibliographic identification, country and institutional context, research methodology, theoretical

framework, focal dimension (alignment, teacher training, or assessment), reported challenges, and reported strategies or outcomes. The matrix was independently populated by two coders, and discrepancies were resolved through deliberative consensus, yielding an inter-coder agreement of $\kappa = 0.84$, indicating substantial reliability.

Analysis followed thematic coding procedures combining open and axial coding. In the open coding stage, segments of each article relevant to the integration of OBE and deep learning were inductively labeled. In the axial coding stage, codes were clustered into thematic categories, namely alignment architecture, teacher capacity, assessment practice, and deep learning outcomes. Cross-case synthesis was then employed to identify recurring patterns, contradictions, and theoretical convergence points across studies. The validity of the analysis was strengthened through investigator triangulation, theoretical triangulation across constructive alignment theory, and self-determination theory (Deci & Ryan, 2000), and achievement goal theory (Ames, 1992)and through audit-trail documentation of all analytical decisions. The review process spanned six months, from initial screening to final synthesis, and was conducted under institutional ethics clearance for literature-based research.

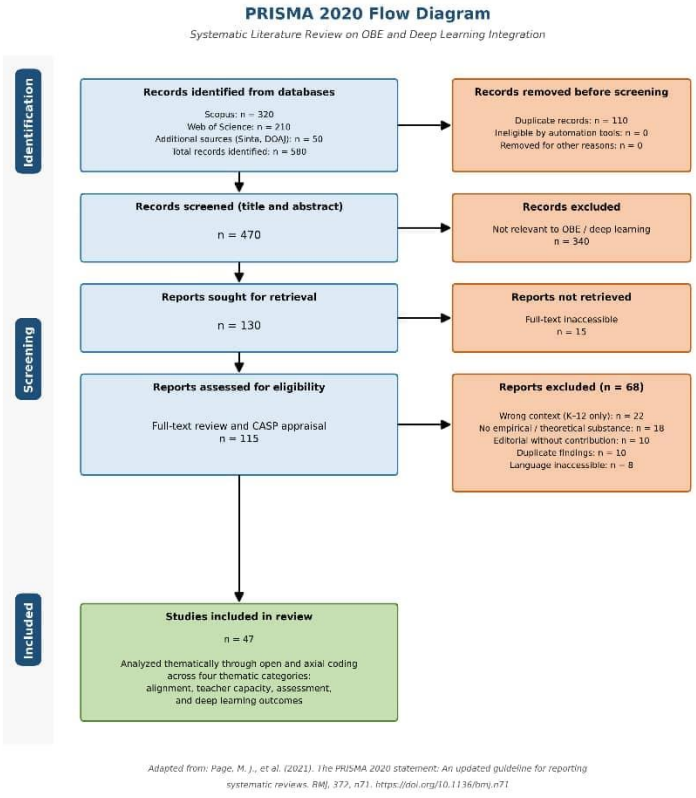

Figure 1 Prisma Flow Diagram

C. Result and Discussion

The synthesis of forty-seven Scopus-indexed studies yielded four interrelated findings. These are presented descriptively in the following subsections, while their interpretation is reserved for the Discussion.

1. Alignment Gaps Between CLOs and PLOs

Across 21 of the analyzed studies, alignment gaps between Course Learning Outcomes (CLOs) and Program Learning Outcomes (PLOs) were the most frequently reported structural issue. Studies from engineering education contexts indicated that misalignment occurs both

vertically, when CLOs do not adequately map to PLOs and program outcomes, and horizontally, when assessment tasks fail to mirror declared CLOs (Choudhari et al., 2026; Haritha et al., 2024; Rajak et al., 2026). Reported alignment gap magnitudes ranged from 12% to 38% of mapped CLO-PLO relationships, depending on program maturity and accreditation status.

Quantitative tools, such as CO-PO mapping matrices and weighted alignment indices, were consistently identified as effective for diagnosing and reducing these gaps (Arun Kumar, 2020; Choudhari et al., 2026). Studies also emphasized that gap reduction is rarely a one-off curricular intervention; instead, it requires periodic recalibration and supplementary measures such as Content Beyond the Syllabus initiatives, including industry shadowing, seminars, and software training that ensure compliance with both academic and industry expectations (Choudhari et al., 2026; Haritha et al., 2024) Studies in English language teaching contexts (Pulungan et al., 2024) similarly reported that textbooks and instructional materials were not always aligned with declared OBE elements, calling for systematic content audits.

2. Teacher Training and Capacity Building

Fourteen studies emphasized teacher training as a determinant of OBE-deep learning integration. The literature consistently noted that even well-designed OBE curricula fail to produce deep learning outcomes when instructors lack the requisite pedagogical literacy (Felder & Brent, 2003; Wang et al., 2011). Effective training programs were characterized by three features: (a) outcome-driven instructional design competence, particularly in formulating action-oriented CLOs; (b) facilitation skills for active and generative pedagogies such as case-based, project-based, and flipped learning; and (c) assessment literacy, including the design of rubrics, formative assessments, and feedback strategies.

Several studies reported that web-based and digital OBE frameworks significantly enhanced instructor readiness when accompanied by structured professional development pathways (Pradeesh et al., 2025; Pulungan et al., 2024). The capacity-building literature also highlighted that personalized teaching strategies, supported by digital learning analytics, enable educators to align instructional content with individual student learning paths, thereby fostering autonomy-supportive environments consistent with self-determination theory (Deci & Ryan, 2000).

3. Assessment Practices for Deep Learning

Eighteen of the reviewed studies addressed assessment as a critical lever in OBE-deep learning synergy. The literature consistently distinguished between assessment of learning, characterized by summative, end-point evaluations, and assessment for learning, which emphasizes formative, ongoing feedback during the learning process (Biggs et al., 2001; Pang et al., 2009; Wang et al., 2011). The studies suggest that OBE systems dominated by assessment of learning tend to incentivize surface learning, whereas systems incorporating diverse formative tools more effectively stimulate deep learning approaches.

Emerging models in the recent literature propose dynamic, multidimensional assessment combining process evaluation, summative evaluation, social evaluation, and value-added evaluation (Arun Kumar, 2020; Pradeesh et al., 2025). Such models embed continuous feedback loops, enabling iterative refinement of teaching practice and personalized remediation. Studies on AI-driven personalized learning further demonstrate that knowledge-concept-centric evaluation can provide granular insights into student mastery, supporting both pedagogical decision making and learner self-regulation (Pradeesh et al., 2025).

4. Adoption of Deep Learning Approaches in OBE Settings

Eleven studies provided direct evidence on the relationship between OBE implementation and student learning approaches. (Pang et al., 2009; Wang et al., 2011), Based on case studies in Hong Kong, researchers found that students in constructively aligned, outcome-based courses were significantly more likely to adopt deep learning approaches and less likely to engage in surface learning. Consistent results were reported by (Biggs et al., 2001; Trigwell, 2005) using the Study Process Questionnaire (R-SPQ-2F) in multiple jurisdictions, suggesting that the structural environment created by OBE, when aligned and supported by adequate teaching and assessment, enhances meaningful engagement. However, when implementation is misaligned or limited to compliance, deep learning adoption is significantly attenuated.

DISCUSSION

The findings of this synthesis can be discussed along five interconnected lines. First, they directly address the research questions concerning the persistent obstacles to integrating OBE with deep learning and the integrative model needed to overcome them. Second, they show how these findings were obtained through cross-study synthesis. Third, they offer an interpretation grounded in established theory. Fourth, they connect emerging findings with the broader knowledge structure of educational management. Fifth, they propose a theoretical extension or modification of constructive alignment theory.

1. From Compliance to Coherence: Reframing Alignment

The first key finding that alignment gaps remain pervasive despite widespread OBE adoption directly answers the question of why outcome-based reforms have not consistently delivered the deep learning benefits they promise. The persistence of misalignment, even after two decades of OBE diffusion (Felder & Brent, 2003; Harden, 2002), suggests that alignment is often treated as a documentary or accreditation exercise rather than a pedagogical principle (Choudhari et al., 2026; Rajak et al., 2026). This interpretation aligns with (Biggs, 1996) original insight that alignment is meaningful only when it operates within a constructivist epistemology in which learners actively build knowledge through aligned learning activities. The current findings thus extend Biggs's framework by indicating that constructive alignment cannot rely on mapping matrices alone; it must be operationalized as a continuous, evidence-driven recalibration process supported by Content Beyond the Syllabus initiatives and quantitative gap analyses (Choudhari et al., 2026; Haritha et al., 2024).

2. Teacher Capacity as the Generative Engine

The second strand of findings highlights that teacher training serves as the generative engine of the synergy between OBE and deep learning. This is consistent with (Felder & Brent, 2003) observation that designing courses to satisfy outcome-based accreditation criteria fundamentally depends on faculty pedagogical capability. (Pang et al., 2009; Wang et al., 2011) extend this argument by showing that learning approaches change in response to teacher behaviors, not merely curriculum design. From a self-determination theory perspective (Deci & Ryan, 2000)Well-prepared teachers create autonomy-supportive learning environments that satisfy students' psychological needs for competence, autonomy, and relatedness, thereby enabling intrinsic motivation and deep engagement. The convergence of these arguments with (Ames, 1992)

Achievement goal theory further suggests that classroom goal structures, mediated by teachers, are central to whether OBE produces a mastery orientation or merely a performance orientation.

The literature also reveals an emerging shift toward technology-enhanced teacher training, in which AI-driven personalization, learning analytics, and adaptive content recommendation systems augment instructor capacity (Pradeesh et al., 2025; Pulungan et al., 2024). This trajectory aligns with the broader transformation of educational professionalism described by (Frenk et al., 2010), in which competent practitioners are increasingly expected to work within digitally enabled, interdependent systems. The synergistic model proposed here, therefore, treats teacher capacity not as an auxiliary input but as a structural pillar of the integration of OBE and deep learning.

3. Dynamic Assessment as Continuous Feedback

The third strand of findings indicates that assessment practices remain the most contested terrain of OBE implementation. While (Harden, 2002, 2007) work positioned outcomes as the natural anchor of educational design, contemporary studies show that excessive reliance on summative assessment can paradoxically depress the deep learning that OBE aims to enable (Pang et al., 2009; Wang et al., 2011). This interpretation is supported by (Biggs et al., 2001), whose Study Process Questionnaire demonstrated that students calibrate their learning approach to the perceived assessment demands of a course. When assessments reward reproductive performance, students adopt surface approaches even when CLOs ostensibly target higher-order outcomes.

The emerging dynamic assessment model combining process, summative, social, and value-added evaluations addresses this paradox by embedding continuous feedback into the learning cycle (Arun Kumar, 2020; Pradeesh et al., 2025). This is consistent with the broader movement in educational management toward formative analytics and learner-centered evaluation. The findings further suggest that AI-driven, knowledge-concept-centric assessments can transform feedback from a periodic event into a near-real-time intervention, allowing instructors and learners to identify and address conceptual gaps as they emerge. This is a substantive extension of Biggs's constructive alignment, which historically emphasized aligning summative tasks with outcomes rather than the temporal granularity of feedback.

4. Toward a Synergistic Model

Synthesizing the three preceding strands, the discussion converges on a synergistic model of OBE and deep learning composed of three interdependent pillars and two enabling dimensions. The three pillars are: (a) Alignment Architecture, encompassing CLO-PLO mapping, Content Beyond the Syllabus, and curriculum compliance; (b) Teacher Capacity, encompassing instructional design literacy, generative pedagogies, and assessment literacy; and (c) Dynamic Assessment, encompassing formative, summative, social, and value-added evaluation. The two enabling dimensions are Adaptive Personalization, enabled by digital and AI-driven tools (Pradeesh et al., 2025), and Continuous Feedback Loops, which connect the pillars temporally and pedagogically.

This model modifies (Biggs, 1996) constructive alignment by retaining its core constructivist premise while extending it in three respects. First, it foregrounds teacher capacity as an explicit structural pillar rather than an implicit precondition. Second, it expands the assessment dimension from outcome-aligned tasks to a multidimensional, technology-enhanced feedback ecosystem. Third, it integrates adaptive personalization, recognizing that students do not learn in homogeneous trajectories and that deep learning is best fostered when learning paths are

differentiated. The model also confirms, rather than contradicts, the outcome-based traditions established by (Harden et al., 1999) and Spady's foundational OBE philosophy, while updating them for digitally mediated learning ecologies.

5. Implications for Educational Management

From an educational management perspective, the synergistic model implies that institutional leaders must reconceptualize OBE governance from a compliance-driven posture toward a capability-building posture. Resource allocation should prioritize sustained faculty development, learning analytics infrastructure, and integrated assessment systems rather than one-off curriculum revisions. Quality assurance frameworks should incorporate indicators that capture not only outcome attainment but also the depth of student engagement, the continuity of feedback, and the adaptiveness of learning experiences. This perspective resonates with (Frenk et al., 2010) call for a new generation of professional education that transforms learning systems to meet interdependent global challenges. For Indonesian higher education in particular, this implies the need to align OBE implementation with national accreditation standards while simultaneously investing in digital pedagogical capacity and contextually relevant assessment innovations.

D. Conclusion

This study set out to examine how Outcome-Based Education (OBE) and deep learning can be integrated through a synergistic model that addresses alignment gaps, teacher training, and assessment practices. Through a systematic literature review of Scopus-indexed scholarship, the analysis identified three recurring structural obstacles and corresponding strategic responses. Alignment gaps between Course Learning Outcomes and Program Learning Outcomes can be reduced through quantitative mapping matrices and Content Beyond the Syllabus initiatives. Teacher training emerges as the generative engine of synergy when it cultivates outcome-driven instructional design, generative pedagogies, and assessment literacy. Dynamic assessment, combining process, summative, social, and value-added evaluations, transforms feedback into a continuous lever for deep learning.

The principal theoretical contribution of this study is the articulation of a synergistic model that extends Biggs's constructive alignment theory by integrating teacher capacity as a structural pillar, expanding the assessment dimension into a continuous feedback ecosystem, and incorporating adaptive personalization through digital and AI-driven tools. Practically, the model provides a roadmap for institutional leaders and educational managers seeking to move OBE implementation beyond compliance toward generative deep learning. Limitations of the study include reliance on published literature, which may underrepresent unpublished institutional experiences, and the predominance of Asian and engineering contexts in the sampled studies. Future research should empirically test the proposed model through longitudinal and multi-institutional studies, particularly in Indonesian higher education and across diverse disciplinary contexts, and further explore how emerging artificial intelligence technologies can be ethically integrated into the synergistic OBE-deep learning ecosystem.

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