Competency-Based Education Research Journal, 2026, 3(1)
https://journals.ku.edu/cberj/

# A Scoping Umbrella Review of Competency-Based Education: Part II – Toward A Conceptual Meta-Framework Through a Synthesis of Theories, Models, and Frameworks

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Competency-based education (CBE) has fragmented theoretical foundations, creating implementation and research challenges despite broad adoption. Part I of this study revealed inconsistent theoretical approaches across disciplines, hindering scalability and effectiveness. Part II proposes a unifying meta-framework integrating CBE theories, frameworks, and stage-based learner development models. This structure aligns learner needs, interventions, and outcomes across novice-to-expert stages, fostering coherent, evidence-driven practices. The proposed meta-framework provides a foundation for systematic CBE design, implementation, and evaluation by identifying stage-specific learner challenges and corresponding interventions, clarifying intervention mechanisms and outcome measures, and linking theory to practice for adaptive learning pathways. It also supports innovative research designs to efficiently refine stage-based interventions. By bridging theoretical gaps and enhancing methodological rigor, this meta-framework advances CBE's capacity to deliver targeted, scalable, and measurable educational outcomes.

*Keywords*: competency-based education, meta-framework, outcomes, stage-based interventions

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Competency-based education (CBE) is not a new concept but is still an evolving field across the disciplines (Hamed et al., 2023). The absence of a universally accepted definition has resulted in a lack of standardized practices and theoretical foundations, posing challenges to the consistent definition and implementation across disciplines (Book, 2014; Riesman, 1979). As efforts to address these challenges continue, understanding how CBE is theorized and applied in different settings is crucial to its future development.

While CBE is commonly framed as a pedagogical approach centering on instructional strategies and learner development, in many K-12 and institutional contexts, CBE is most accurately conceptualized as a systems change initiative (Evans et al., 2020). In these settings, adoption of CBE often requires broad shifts not only in pedagogy, but also in curriculum design, grading and assessment policies, teacher roles, organizational structures, and stakeholder engagement (Mani, 2025). Clarifying this distinction makes it possible to recognize both the pedagogical and systemic dimensions of CBE as addressed in this study. For example, in some K-12 school districts, transitioning to CBE has required replacing traditional seat-time requirements with competency-based progression, adopting new forms of student assessment, revamping curricular frameworks, and creating new support for professional learning among teachers, all of which illustrate CBE as a comprehensive systems change rather than solely a shift in instructional practices.

In Part I of this series of papers, the theoretical approaches to CBE employed in research and practice across various disciplines and contexts were examined. A taxonomy of these approaches was developed, highlighting key features, trends, and focal areas across diverse educational contexts, fields, and geographical regions (Kang et al., 2025). The analysis revealed that while CBE is a field with growing efforts to strengthen its theoretical foundations, its diversity in underlying theories, models, and frameworks has resulted in significant fragmentation (Açıkgöz & Babadoğan, 2021). This theoretical inconsistency poses challenges for ensuring the consistent and structured implementation of CBE, as well as for conducting research across disciplines (Foroughi et al., 2022; Oyugi, 2015).

The current study (Part II) aims to develop a comprehensive meta-framework for CBE by synthesizing the current theoretical approaches to CBE that have been addressed in reviews across various domains including education, engineering, medicine, and other relevant fields. A meta-framework for CBE is proposed as a conceptual and methodological strategy rather than a new standalone theory. This approach synthesizes existing theories, models, and frameworks, providing a flexible and integrative structure adaptable to any theories deemed appropriate for different educational contexts. By framing CBE through this meta-framework, the central question is clarified, not only what constitutes CBE, but also how these diverse theoretical perspectives can be unified to guide effective implementation, assessment, and research.

The creation of such a meta-framework for CBE holds significance in that it establishes the foundation for analyzing, designing, developing, implementing, and evaluating effective evidence-based practices in CBE. This framework aims to address challenges related to outcome measurement in CBE and proposes an integrated approach tailored to each phase or stage of implementation. To translate these goals into practice and offer actionable guidance, the meta-framework is organized around two core principles that inform its design and application. These guiding principles serve as the foundation for connecting theory to practical strategies across diverse educational contexts, ensuring that CBE practices can be both adaptable and rigorously evaluated for their efficacy and effectiveness.

Two guiding principles underpin this framework. The first is the stage-based structure of personalized learning within the meta-framework. As learners progress through successive stages, the nature of their learning challenges and needs shifts, as does the effectiveness of different instructional strategies (Frank et al., 2024). For CBE to be effective, interventions must be intentionally designed and timed to meet the specific demands of each stage (Prokes et al., 2021). The major stage- or phase-based models identified in the literature from Part I are synthesized into a conceptually universal, parsimonious, and integrative stage-based model. This synthesized model consolidates the foundations of personalized learning within a meta-framework for CBE and provides a structured yet flexible framework for delivering timely, tailored support aligned with learners' evolving needs. Outcome measures from the literature can be systematically mapped to these stages, supporting more precise and meaningful evaluation of CBE interventions.

The second guiding principle is that instructional design and strategies should be informed by the dynamic interplay between learner challenges and intervention opportunities, based on major theories and frameworks aligned with each stage. These factors evolve over time and must be carefully considered when selecting and timing educational strategies. Interventions should directly address the immediate, stage-specific challenges learners face and contribute to long-term outcomes such as sustained progress toward mastery (Springpoint, 2019). This framework helps educators and researchers determine *what* to implement, *when* to implement it, and *how* to evaluate its effectiveness (van Melle et al., 2019).

## Integrating and Aligning Stage-Based Models, Theories, and Frameworks: Foundations and Applications of the Three-Stage Meta-Framework for CBE

### Step 1. Integration of the Stage-Based Models into a Meta-Framework

The first step in creating a meta-framework for CBE is to unify existing stage- or phase-based models that emphasize individual development and personalized learning, thereby establishing a solid foundation for the meta-framework. Its primary goal is to guide the selection, implementation, and evaluation of effective instructional interventions at each stage of the learner's development. To do this, the model addresses two fundamental questions:

1. What specific challenges and opportunities for intervention emerge at each developmental stage?
2. Which instructional strategies are best suited to address these stage-specific needs effectively?

At the heart of this integrated stage-based model is the recognition that learning in CBE unfolds through distinct, practically defined stages or phases, each marked by evolving learner needs, challenges, and opportunities for targeted instructional support (Rosenberg, 2012). These stages or phases are not arbitrary; they represent meaningful developmental transitions on the learning journey from novice to expert (Persky & Robinson, 2017). The model acknowledges that the relevance of interventions, challenges, or outcome measures shifts across these stages or phases, depending on the learner's progression and context (Harden, 2007).

The integration of various stage-based models is crucial to the development of a comprehensive meta-framework for CBE, for several compelling reasons. Stage-based models inherently recognize that expertise is built through progressive stages, and integrating multiple models enriches understanding of how learners move from novice to expert, offering a more holistic perspective than any single model can provide (Gupta et al., 2024). Moreover, different models emphasize distinct facets of learning, particularly psychomotor development and skill acquisition, such as in the works of Dreyfus and Dreyfus and Fitts and Posner (e.g., Rajaratnam et al., 2021; Roberts et al., 2012); pedagogical, as exemplified by the six-step framework (e.g., Sawyer et al., 2015); and cyclical, as illustrated by Kolb experiential learning theory and self-regulated learning (e.g., Lengetti et al., 2020; Roberts et al., 2012). A synthesized approach captures the full complexity of competency development across knowledge, skills, and attitudes (Gupta et al., 2024). Despite their differences, many models share foundational assumptions about how learning occurs and expertise develops (Açıkgöz & Babadoğan, 2021). Integrating these models allows us to surface these core principles and construct a more universally applicable framework that transcends disciplinary boundaries (Cravero et al., 2024; Gupta et al., 2024). This composite framework also enhances adaptability across subject areas, learning environments, and learner profiles by accounting for various pathways to skill acquisition (Or, 2024). Finally, by clearly identifying the characteristics of each developmental stage, the framework can inform the design of assessments that more accurately capture learner progress and outcomes, supporting more appropriate and effective evaluation strategies (Harden, 2007). Figure 1 illustrates how each of the major stage-based models is positioned along the novice-to-expert continuum.

Synthesizing models that span cognitive, psychomotor, and pedagogical dimensions, capture the developmental complexity of learning across stages such as novice, competent, and expert (Sawyer et al., 2015). This approach reveals shared principles, enhances adaptability, and provides a practical structure for guiding intervention design and assessment. Ultimately, the meta-framework empowers educators and researchers to deliver more effective, personalized learning experiences and to support learners' meaningful progression toward mastery (Gupta et al., 2024; Or, 2024).

**Figure 1**

*Major Stage-based Models on Novice-to-Expert*

Novice-to-Expert Continuum: Novice ⟷ Expert

| CBE Models (Stage-Based, Pedagogical, Cyclical) | Novice | | | | | | | Expert |
|---|---|---|---|---|---|---|---|---|
| Dreyfus and Dreyfus's Skill Acquisition Model | Stage 1. Novice | Stage 2. Advanced Beginner | Stage 3. Competent | Stage 4. Proficient | Stage 5. Expert | | | |
| Fitts and Posner's Three-Stage Model of Motor Skills Acquisition | Stage 1. Cognitive (Learning) | Stage 2. Associative (Motor Behavior) | Stage 3. Autonomous (Expert) | | | | | |
| Simpson's and Harrow's Taxonomy of Psychomotor Skill Development | Stage 1. Guided Response | Stage 2. Mechanism | Stage 3. Complex Overt Response | Stage 4. Adaptation | Stage 5. Originating | | | |
| Kovacs's Psychomotor Learning Theory | Stage 1. Learn | Stage 2. See | Stage 3. Practice | Stage 4. Do | | | | |
| Six-step Pedagogical Framework | Stage 1. Learn | Stage 2. See | Stage 3. Practice | Stage 4. Prove | Stage 5. Do | Stage 6. Maintenance | | |
| Gallagher and Colleagues' 8-step Model | Stage 1. Didactic Teaching | Stage 2. Instruction on Steps | Stage 3. Illustrating Common Error | Stage 4. Testing knowledge | Stage 5. Simulation training | Stage 6. Immediate Feedback | Stage 7. Summative Feedback | Stage 8. Repeated Skill Training |
| McClusky and Smith's 3-step Model | Stage 1. Cognitive Learning: Task Procedure | Stage 2. Simulation-based Training | Stage 3. Independent Hands-on Practice in Real-World | | | | | |
| Aggarwal and Colleagues' Competency-Based Framework | Stage 1. Knowledge Acquisition | Stage 2. Technical Training | Stage 3. Proficiency-based Training | | | | | |
| Concrete-Representation-Abstract (CRA) Model for Skill-Based Mastery Learning | Stage 1. Concrete | Stage 2. Representation | Stage 3. Abstract | | | | | |
| Rodolfa's Cube Model of Development of Foundational Competencies | Stage 1. Doctoral Education (Foundational Knowledge) | Stage 2. Doctoral Internship and Residency (Practical Experience) | Stage 3. Postdoctoral Supervision (Development of Specific Competencies) | Stage 4. Residency and Fellowship (Independent Practice) | Stage 5. Continuous Development of Professional Competencies | | | |
| Kolb Experiential Learning Theory | Stage 1. Concrete Experience | Stage 2. Reflective Observation | Stage 3. Abstract Conceptualization | Stage 4. Active Experimentation | | | | |
| Self-Regulated Learning | Stage 1. Forethought & Planning | Stage 2. Performance | Stage 3. Self-reflection | | | | | |

***Characteristics of Each Stage in the Proposed Three-Stage Model***

Based on each model's placement along the novice-to-expert continuum in Figure 1, a three-stage model is proposed, derived from a synthesis of stage-based models. Table 1 illustrates how each of these models aligns with the three-stage framework proposed in this study. Drawing from these alignments, key learner characteristics are identified for each stage. For example, in Stage 1, novices tend to follow the rules strictly, lack contextual awareness, and demonstrate limited judgment (Roberts et al., 2012; Torralba et al., 2020). They learn primarily through imitation and trial-and-error, often perform tasks inconsistently despite understanding instructions, and typically grasp concrete concepts before abstract ones (Parker & Roumell, 2020). At this stage, learners acquire foundational knowledge through coursework and research and begin to engage in forethought and planning by breaking down tasks into manageable components (Sawyer et al., 2015).

Notably, many students entering CBE environments, particularly at the Novice stage, have prior experience with compliance-based instruction where expectations are rigid and learning is teacher-directed (Boyer et al., 2021). This can create a mismatch between their readiness for independent learning and the greater agency required by CBE's self-paced, mastery-oriented structure (Cullen & Oppenheimer, 2024). As a result, novices may struggle to exercise autonomy, make choices about their own learning, or persist in the face of ambiguity. It is therefore essential for CBE programs to intentionally foster human skills such as self-regulation and metacognition alongside the acquisition of technical knowledge and competencies (Boyer et al., 2021; Chacko, 2014). Specific interventions such as explicit instruction in goal-setting, time management, and reflective practice can help scaffold the transition, support learner autonomy, and ensure that novices are progressively prepared for the increasing independence expected as they advance through the stages (Ponomariovienė & Jakavonytė-Staškuvienė, 2025).

**Table 1**

*An Integrated Stage-Based Model Based on the Novice to Expert Continuum*

| Stages Proposed in this Study | Stage 1. Novice Stage<br>Strictly adhere to given rules, lack flexibility, and rely heavily on guidelines and concrete experiences to complete tasks. | Stage 2. Intermediate Stage<br>Demonstrate efficient task execution, apply theoretical knowledge practically, reflect on experiences, and integrate cognitive and social processes for skill development. | Stage 3. Expert Stage<br>Exhibit autonomy, analytical proficiency, effortless mastery, sustained skills through practice, adaptability, continuous development, and application of learning in diverse contexts. |
|---|---|---|---|
| | | **1. Stage-Based Models** | |
| Dreyfus and Dreyfus Stages of Learning [8, 21, 24, 33] | Stag 1. Novice<br>· Strictly following prescribed rules or plans.<br>· Lack of awareness of the context.<br>· Lack of the ability to make discretionary judgments.<br>Stage 2. Advanced Beginner<br>· Instructions for behavior determined by specific characteristics or qualities.<br>· Limited awareness of situational factors persists.<br>· All attributes and aspects addressed individually and considered equally important. | Stage 3. Competent<br>· Perceiving actions at least partially in terms of longer-term goals.<br>· Engaging in deliberate planning.<br>· Utilizing standardized and routinized procedures.<br>Stage 4. Proficient<br>· Understanding situations holistically rather than focusing on specific elements.<br>· Identifying the most significant aspects of situations.<br>· Recognizing deviations from typical patterns.<br>· Experiencing effective decision-making processes. | Stage 5. Expert<br>· No longer depending on rules or guidelines.<br>· Having intuitive grasp of situations based on deep understandings.<br>· Utilizing analytical methods for unfamiliar scenarios or when issues arise.<br>· Predicting potential outcomes. |
| Fitts and Posner's three-stage model of motor skills acquisition [19, 32] | Stage 1. Cognitive (or Learning)<br>· Comprehending the task through explanation and demonstration but executing it inconsistently in separate and unique stages. | Stage 2. Associative (or Motor Behavior)<br>· Smoothly execute tasks with fewer interruptions with repeated practice and feedback.<br>· Effectively translating knowledge into appropriate motor behavior. | Stage 3. Autonomous (or Expert)<br>· Executing the task with minimal effort, with little cognitive load, and reaching the mastery level nearly automatically. |

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| Simpson's and Harrow's Taxonomy of the Psychomotor Skill Development [24] | Stage 1. Guided Response<br>· Learning skills, primarily involving imitation and experimentation (trial and error).<br>Stage 2. Mechanism<br>· Performing the movements associated with skills with some proficiency and confidence. | Stage 3. Complex Overt Response<br>· Performing a procedure competently with quick, accurate, and highly coordinated performance.<br>Stage 4. Adaptation<br>· Modifying movements to adapt to difficult situations. | Stage 5. Originating<br>· Creating new movement patterns tailored to a specific situation or novel challenge. |
| **2. Pedagogical Models** | | | |
| Kovacs's psychomotor learning theory [24] | Step 1. Learn<br>· Learning about the procedure and acquiring the requisite cognitive knowledge.<br>Step 2. See<br>· Seeing the procedure performed by an instructor or expert. | Step 3. Practice<br>· Practicing the procedure after learning and seeing the procedure. | Step 4. Do<br>· Continuing to practice the procedure on a stakeholder. |
| Six-step Pedagogical Framework [24] | Phase 1. Cognitive Phase<br>Sub-phase 1. Learn (Conceptualization)<br>· Learning about the procedure and acquiring the requisite cognitive knowledge.<br>Sub-phase 2. See (Visualization)<br>· Observing the procedure performed by an instructor or expert, including nonverbal and verbal instruction. | Phase 2. Psychomotor Phase<br>Sub-phase 1. Practice<br>· Practicing the procedure with deliberate practice.<br>Sub-phase 2. Prove<br>· Proving competency through simulation-based assessment. | Phase 2. Psychomotor Phase<br>Sub-phase 3. Do<br>· Allowing to perform the procedure on a stakeholder.<br>Phase 3. Maintain Phase<br>Sub-phase 1. Maintain<br>Maintaining skills through both clinical practice and simulation, with simulation acting as supplementary training or refresher training. |

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| Gallagher and colleagues' 8-step model [31] | Step 1: Provide didactic instruction on relevant knowledge.<br>Step 2: Provide detailed instruction on executing the task or procedure.<br>Step 3: Explain common errors.<br>Step 4: Assess the understanding of cognitive skills acquired in previous steps before proceeding to technical skills training. | Step 5: Deliver technical skills training using the simulator.<br>Step 6: Provide immediate feedback when an error occurs. Step 7: Provide summative feedback when an error occurs. | Step 8: Conduct iterative skills training with repeated trials, while documenting progress at the end of each trial through evidence. This process should reference a proficiency performance goal that the trainee is expected to achieve. |
| McClusky and Smith's 3-step model [31] | Step 1.<br>In the initial step, the cognitive aspects of the task or procedure are taught using suitable resources. After acquiring the necessary cognitive skill set, the innate abilities of trainees are assessed. | Step 2.<br>Simulator-based training is utilized to translate cognitive understanding into motor skills. Initially, training is conducted under the guidance of instructors who offer performance feedback. | Step 3.<br>Training progresses through independent practice until predefined proficiency criteria are met. This advancement extends across tasks of escalating complexity until the simulator-based phase of the curriculum concludes.<br>Once performance benchmarks are met in the skills lab, trainees transition to real-world environments where they gain hands-on experience with patients and refine their skills. |
| Aggarwal and colleagues' competency-based framework for systematic training and assessment of technical skills [31] | Step 1.<br>The process of learning technical skills commences with acquiring knowledge specific to the procedure. | Step 2.<br>Once this knowledge is confirmed through testing, technical training begins. The task to be taught is broken down into its key components to facilitate learning. Trainees are provided with video recordings of the procedures, and objective performance assessment tools are defined. Training models for the specific task are subsequently developed and validated. | Step 3.<br>Proficiency-based training using these validated models is then implemented in the skills laboratory, and the skills acquired are transferred to real-world environments. This ensures consistency in objective assessment between the laboratory and real settings, employing similar assessment methods. |

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| Concrete-representation-abstract (CRA) model for skill-based mastery learning [17] | Stage 1. Concrete<br>· Learning concrete subjects using concrete resources (i.e., hands-on experiences) before learners to more abstract concepts. | Stage 2. Representation<br>· Using visual representations of concrete objects to connect the physical and abstract world. | Stage 3. Abstract<br>· Gaining a deeper understanding of abstract world and concepts. |
| Rodolfa's Cube model of development of foundational competencies [32] | Stage 1. Doctoral Education<br>· Acquiring a foundational knowledge base through coursework and research.<br>Stage 2. Doctoral Internship and Residency<br>· Gaining practical experience applying their foundational knowledge in real-world settings under supervision. | Stage 3. Postdoctoral Supervision<br>· Allowing for focused development of specific functional competencies relevant to their chose area of practice.<br>Stage 4. Residency and Fellowship<br>· Transitioning from training to independent practice in the real world. | Stage 5. Continuing Competency<br>· Continuing to develop professional competencies. |

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|---|---|---|---|
| **3. Cyclical Models** | | | |
| Kolb experiential learning theory [6, 21] | Stage 1. Concrete Experience<br>· Gaining new experiences or reinterpreting past ones. | Stage 2. Reflective Observation<br>· Reflecting on and analyzing the experience. | Stage 3. Abstract Conceptualization<br>· Forming new ideas and generalizing from experience.<br>Stage 4. Active Experimentation<br>· Applying the new learning to test its validity in new situations. |
| Self-regulated learning [2, 11, 13, 23] | Phase 1. Forethought & Planning<br>· Engaging in processes where learners establish strategies to complete a task or achieve an objective, encompassing task breakdown and motivational beliefs. | Phase 2. Performance<br>· Utilizing tactics and skills as they progress towards accomplishing a task or objective. | Phase 3. Self-Reflection<br>· Reflecting their progress towards their objective, or the outcomes if they have reached the goal or finished the task.<br>· Employing self-assessment and self-response as parts of this self-reflection. |

*Note.* Please refer to the Appendix for a list of articles associated with each theory, model, and framework.

In Stage 2, competent learners perform tasks more efficiently and with fewer interruptions through continued practice and feedback (Roberts et al., 2012; Sawyer et al., 2015). They apply their knowledge in practical contexts, use visual aids to bridge concrete and abstract concepts, and reflect on their experiences to deepen understanding (Parker & Roumell, 2020). They demonstrate competency through assessments such as simulations, engage in repeated practice of procedures, and integrate cognitive and social processes to learn from mistakes (Sawyer et al., 2015; Stefanidis, 2010). Additionally, they prioritize key concepts, develop reflective assessments, and progressively apply their skills to achieve learning objectives.

In Stage 3, experts operate autonomously, guided by intuitive understanding rooted in deep knowledge (Rajaratnam et al., 2021). They demonstrate strong analytical skills in both familiar and unfamiliar situations, possess predictive abilities, and perform tasks efficiently with minimal cognitive effort, hallmarks of mastery (Persky & Robinson, 2017; Rajaratnam et al., 2021). They maintain their skills through regular practice and ongoing training, show adaptability by generating novel solutions, and have a profound grasp of abstract concepts within their domain (Parker & Roumell, 2020). Additionally, they engage in continuous professional development, apply critical thinking and self-assessment, and effectively transfer their learning to new contexts (Lengetti et al., 2020).

***Rationale for Adopting a Three-Stage Model in a Meta-Framework for CBE***

Integrating diverse stage-based models into the proposed three-stage model (Novice → Intermediate → Expert) in this study is essential for developing a comprehensive and theoretically grounded meta-framework for CBE. Adopting this three-stage structure rather than a more complex, multi-stage model such as Dreyfus and Dreyfus's Stages of Learning, Gallagher's Eight-Step Model, or Kovacs's Psychomotor Learning Theory, is a strategic design decision intended to provide a framework that is conceptually clear, parsimonious, and integrative. This streamlined approach captures developmental complexity while remaining accessible and manageable for both educators and learners.

The three-stage model distills the learning continuum into distinct, meaningful phases that are easier to communicate, understand, and implement across varied educational and professional contexts (Tenison & Anderson, 2016). In contrast, models with more numerous stages may offer detailed guidance but are often too context-specific or cumbersome to generalize, limiting their applicability across disciplines. The purpose of a meta-framework is to synthesize the foundational principles of multiple models rather than replicating each one in full. The proposed three-stage structure enables this synthesis by grouping related learning processes and outcomes (cognitive, psychomotor, pedagogical, and experiential) under broader developmental categories that reflect progression in CBE.

A key strength of this model is its alignment with many established theories of learning and skill development. Models such as Dreyfus and Dreyfus's model (Roberts et al., 2012; Sawyer et al., 2015), Fitts and Posner's motor learning stages (Rajaratnam et al., 2021), the concrete-representation-abstract (CRA) framework

(Parker & Roumell, 2020), and self-regulated learning (SRL) (Lengetti et al., 2020; Ross et al., 2022) all converge around three broad stages: (1) initial knowledge acquisition and guided practice (novice), (2) skill refinement and growing autonomy (intermediate), and (3) mastery, flexibility, and independent application (expert). Even detailed models like Gallagher's Eight-Step Model (Stefanidis, 2010) can be logically mapped onto this structure. For example, early instruction and knowledge acquisition align with the novice stage; simulation-based training corresponds to the intermediate stage; and iterative, proficiency-based practice reflects the expert stage.

From a practical standpoint, the proposed three-stage model effectively supports curriculum design, competency assessment, and learner feedback by offering a clear, scaffolded developmental trajectory. It allows for instructional differentiation without imposing unnecessarily rigid or fragmented learning sequences. This flexibility is achieved because each stage provides broad developmental targets rather than prescriptive, step-by-step sequences. For instance, in a health professions curriculum using the three-stage model, novice learners may progress through foundational knowledge acquisition at variable rates, depending on prior experience. Meanwhile, learners at the intermediate or expert stages can participate in simulations or clinical practice as soon as they demonstrate readiness. Instructors are thus able to tailor content and assessment to the needs of individuals or cohorts, without requiring all students to complete identical tasks in a predetermined sequence. This approach preserves coherence in skill development while avoiding fragmentation or unnecessary restrictions in the learning experience.

Moreover, the model enhances the scalability and transferability of CBE by offering a flexible structure that applies across various disciplines and skill domains. On the other hand, models with more granular stages are typically tailored to specific settings (e.g., surgical simulation, nursing practices) and may not translate well to broader CBE applications. Therefore, the proposed three-stage model serves as an optimal macro-level framework to unify diverse learning models, promote coherent skill progression, and support the design and implementation of scalable, adaptable, and discipline-spanning CBE programs.

Within this framework, "time" refers primarily to the variable duration each learner may need to acquire specific competencies at each stage, rather than to a fixed interval applied uniformly to all. This reflects a core principle of CBE: progression is determined by demonstrated mastery, not by seat-time or chronological age (Evans et al., 2020). Accordingly, the framework does not prescribe a fixed schedule or standardized sequence for every learner; instead, it allows individuals to progress at their own pace through each stage. In addition, "time" can also denote the sequencing of competencies or learning experiences (Ford & Meyer, 2015). Sequencing within this model is flexible and responsive to learner readiness, avoiding a rigid, lock-step order for every cohort. This decoupling of progression from fixed time constraints is particularly significant in K-12 contexts, where traditional seat-time policies are replaced by personalized learning trajectories. Thus, the meta-framework explicitly supports both self-paced competency acquisition and adaptable, context-responsive sequencing in alignment with broader CBE definitions.

### *Developing Stage-Based Outcome Measures for CBE*

To meaningfully assess outcomes in CBE, researchers must begin by developing robust causal models that accurately capture the distinct stages or phases of the CBE process. Each stage should be clearly articulated in terms of its purpose, timing, and expected impact on learner development (Persky & Robinson, 2017). This stage-based approach acknowledges a critical reality: As learners move through CBE, they encounter different challenges, pursue evolving goals, and engage with varying opportunities for growth (Evans et al., 2020). Recognizing these dynamic shifts is essential to selecting outcome measures that accurately reflect the complexity and intent of the CBE model (Harden, 2007).

By aligning outcome measures with specific stages of learning, researchers can better capture when and how educational impacts occur and whether each stage is delivering what individual learners need at the right time (Alharbi, 2024). This alignment is not merely a methodological improvement; it is a conceptual necessity for evaluating the effectiveness of CBE in supporting personalized, mastery-based progression (van Melle et al., 2021). Accordingly, a structured framework is proposed in which an integrated stage-based model guides outcome selection. Existing outcomes identified in the literature are also examined to determine how they can be mapped onto this model, ensuring that assessments are both stage-appropriate and learner-centered. Table 2 shows potential outcomes in each stage of the proposed three-stage model addressed in the reviews.

Potential outcomes for novices in Stage 1 center on initial engagement and foundational learning. These include learner satisfaction with educational experience, basic cognitive development and knowledge acquisition, the ability to retain early-stage knowledge, and the emergence of foundational affective traits such as ethical behavior and empathy (Bisgaard et al., 2018; Cook et al., 2013; Henri et al., 2017; Mohieldein, 2017). The primary goal at this stage is to provide initial exposure and build a foundational understanding that supports these outcomes.

As learners advance to the Intermediate stage, the focus on potential outcomes shifts toward the retention and practical application of skills. This includes sustained knowledge related to time, process, and product; demonstrated competence in supervised clinical or psychomotor tasks such as problem-solving and technical procedures; and continued growth in affective domains (Bisgaard et al., 2018; Cook et al., 2013; Mohieldein, 2017). The goal at this stage is skill development and supervised application, aligned with the expected outcomes of Stage 2.

At the Expert stage, potential outcomes emphasize the effective transfer and broader impact of acquired competencies. Learners are expected to apply skills independently in new and complex situations, exhibit proficient unsupervised performance, and maintain consistent quality across time, processes, and outcomes. Additional outcomes include observable behavioral changes, ongoing affective development, positive attitudes toward CBE, a sustained commitment to lifelong learning, and ultimately, improved stakeholder outcomes and learning efficiency (Bisgaard et al., 2018; Cook et al., 2013; Henri et al., 2017; McGaghie et al., 2014;

**Table 2**

*Potential Outcomes Proposed in An Integrated Stage-Based Model*

| Stage-Based Model Proposed in this Study | Potential Outcomes in Each Stage (Novice to Expert Continuum) | | |
|---|---|---|---|
| | Stage 1. Early Stage (Novice) | Stage 2. Middle Stage (Intermediate) | Stage 3. Later Stage (Expert) |
| Potential Outcomes | · Learner's satisfaction [1]<br>· Learning (or cognitive) outcome [6]<br>· Knowledge retention [2, 6, 15, 29]<br>· Affective outcomes (ethical behavior, empathy, or respect for others) [15] | · Retention of skills (i.e., time/process/product) [1, 2]<br>· Supervised clinical performance or psychomotor skill outcomes (problem solving, or performing certain technical procedures) [1, 15]<br>· Affective outcomes (ethical behavior, empathy, or respect for others) [15] | · Immediate skill transfer [1, 14, 15, 17]<br>· Unsupervised clinical performance [1]<br>· Skill (time, process, product) [2]<br>· Behavior (time and process) [2]<br>· Affective outcomes (ethical behavior, empathy, or respect for others) [15]<br>· Positive student attitudes towards CBE courses and programs [6]<br>· Continuous learning intention [6]<br>· Better stakeholder outcomes [14]<br>· Learning efficiency [17] |

*Note*. Some articles that discussed stage-based models (e.g., [11, 16, 28, 34]) did not identify specific outcomes for each stage. Please refer to the Appendix for a list of articles associated with each theory, model, and framework.

Mohieldein, 2017; Parker & Roumell, 2020).[1] The overarching goal of this stage is to achieve independent mastery and meaningful impact, as reflected in the outcomes of Stage 3.

Table 3 shows exemplary challenges learners may encounter at each stage, potential exemplary intervention components the mentor or facilitator might consider, and illustrative exemplary measures of outcomes for assessment. In the Novice stage, novice learners often face challenges such as rigid rule-following, poor time management, limited contextual understanding, low confidence, and confusion from unclear expectations. To support them, structured and scaffolded instruction, frequent formative feedback, peer and academic support systems, and explicit task modeling are effective interventions. Outcomes at this stage can be measured through learner satisfaction, pre/post-knowledge tests, knowledge retention tasks, affective outcome rubrics, and the use of feedback.

At the Intermediate stage, intermediate learners may struggle to apply knowledge in practice, consistently retain skills, and engage in self-regulation and reflection, particularly in large instructional settings. Interventions such as simulation-based practice, deliberate feedback, reflective journaling, collaborative problem-solving, and rubric-guided assessment help address these challenges. Outcomes are measured through skill retention assessments, mentor or facilitator evaluations, reflective journal analyses, affective rubrics, and peer and instructor assessments of collaboration.

At the Expert stage, expert learners face challenges related to performing autonomously, adapting skills to complex or novel situations, sustaining motivation for lifelong learning, and demonstrating real-world impact. Effective interventions include authentic task performance, advanced simulations, leadership roles, ongoing professional development, and multi-source feedback. Outcomes are evaluated through measures of skill transfer, unsupervised performance ratings, stakeholder outcomes, self-assessment of learning intentions, attitudes toward CBE, and evidence of adaptability and innovation.

In summary, the challenges, interventions, and outcome measures outlined across the three developmental stages proposed in this study reflect both learner-specific characteristics and systemic barriers. Grounded in best practices in CBE, including scaffolding, formative feedback, simulation, and authentic assessment, these intervention components are purposefully aligned to support learners' progression from novice to expert. The identified outcome measures serve as observable indicators that the interventions are functioning as intended, capturing engagement, skill retention, performance in real-world tasks, and affective growth. Overall, it offers a developmental roadmap for implementing CBE, ensuring that educational strategies and assessments evolve in step or stage with learners' growing competencies and needs.

[1] Terms such as 'stakeholder' and 'mentor/facilitator' are used here for generalizability and may refer, as appropriate, to supervisors, clients, patients, managers, or other individuals relevant to the context.

**Table 3**

*Exemplary Challenges, Intervention Components, and Outcome Measures Proposed in An Integrated Stage-Based Model*

| Stage | Novice | Intermediate | Expert |
|---|---|---|---|
| Exemplary Challenges | - Rigid adherence to rules and lack of flexibility<br>- Difficulty with self-paced learning and time management<br>- Limited context awareness and judgment<br>- Low confidence and inconsistent execution<br>- Overload from too many choices or unclear expectations | - Difficulty transferring knowledge to practice<br>- Inconsistent skill retention and performance under supervision<br>- Need for more complex, authentic assessment<br>- Limited reflection and self-regulation<br>- Instructor capacity overload in large classes | - Ensuring autonomous, unsupervised performance<br>- Generalizing and adapting skills to novel/complex contexts<br>- Maintaining continuous learning and motivation<br>- Measuring transfer to real-world and stakeholder outcomes<br>- Standardizing assessment at high levels of complexity |
| Exemplary Intervention Components | - Structured, scaffolded instruction and clear, concrete goals<br>- Frequent formative assessments with immediate feedback<br>- Support systems: time management workshops, peer groups, academic advising<br>- Explicit modeling and demonstration of tasks<br>- Early use of digital portfolios to document progress | - Simulation-based and supervised clinical/practical tasks<br>- Opportunities for deliberate practice with targeted feedback<br>- Reflection activities (journals, debriefs) to deepen learning<br>- Peer collaboration and group problem-solving<br>- Use of rubrics for skill and affective outcomes | - Authentic, real-world tasks and unsupervised practice<br>- Advanced simulation and scenario-based assessments<br>- Opportunities for leadership and mentoring roles<br>- Encouragement of continuous learning and professional development<br>- Use of multi-source feedback (360° assessment) |

| | | | |
|---|---|---|---|
| Exemplary Measures of Outcomes | - Learner engagement and satisfaction surveys<br>- Pre/post knowledge assessments (cognitive outcome)<br>- Knowledge retention checks (quizzes, recall tasks)<br>- Affective outcome rubrics (ethical behavior, empathy)<br>- Frequency and quality of feedback utilization | - Retention of skills over time (OSCEs, checklists, timed tasks)<br>- Mentor ratings of clinical/psychomotor performance<br>- Reflective journal analysis (evidence of self-regulation)<br>- Affective outcome rubrics<br>- Peer and instructor assessment of collaboration and problem-solving | - Immediate and long-term skill transfer metrics (performance in new settings)<br>- Unsupervised clinical performance ratings<br>- Stakeholder outcome measures (patient satisfaction, error rates)<br>- Self-assessment of continuous learning intention<br>- Attitude surveys toward CBE and learning efficiency<br>- Evidence of adaptability and innovation in practice (case logs, portfolios) |

## Step 2. Alignment of CBE Theories with the Proposed Three-Stage Model

The stage-based models were first integrated into the proposed three-stage model to create the foundation of a meta-framework for CBE. The next step is to align various theories that support CBE in the literature with each stage of the proposed three-stage model to gain a better understanding of how different theoretical perspectives inform the evolving needs of learners as they progress from novice to expert. This alignment is crucial because it ensures that instructional strategies, assessment practices, and learning environments are grounded in appropriate theoretical foundations at each developmental phase. By mapping theories to stages where they are most relevant, rather than focusing on exclusivity, the meta-framework can guide educators or facilitators in selecting stage-appropriate interventions that support learner motivation, skill acquisition, identity formation, and autonomous expertise. Ultimately, this structured approach enhances the coherence, adaptability, and effectiveness of CBE implementation across diverse contexts.

### *Theories Supporting All Stages*

Outcomes-based Education (OBE) and Mastery Learning (ML) are foundational theories that align well with the three-stage developmental model of a meta-framework for CBE, encompassing the Novice, Intermediate, and Expert stages. Both approaches emphasize the clarity of learning goals, the alignment of instruction and assessment with intended outcomes, the use of formative assessment followed by feedback, and the provision of adequate time and support for learners to achieve proficiency before proceeding to the next stage (Cook et al., 2013; Lengetti et al., 2020). As such, they offer flexible, inclusive, and evidence-based instruction that scaffolds learner progression across all stages of development.

At the Novice stage, learners are introduced to foundational knowledge, skills, and attitudes. OBE's focus on clearly defined learning outcomes (Spady, 1994) helps establish concrete expectations for what novices must know and be able to do, thereby reducing ambiguity and enhancing learner confidence. ML complements this by structuring instruction into discrete units with frequent formative assessments, ensuring learners achieve a minimum level of proficiency before progressing (Bloom, 1968). This approach prevents early failure in the sense that frequent formative assessment and feedback help learners monitor their progress and determine their readiness before attempting summative assessments or demonstrating mastery. By identifying learning gaps early and providing targeted remediation, formative feedback enables novices to achieve necessary proficiency at each step, fostering motivation and reducing the risk of discouragement from premature high-stakes failure.

At the Intermediate stage, learners begin applying foundational competencies to real-world settings in more complex and integrative ways. Both OBE and ML continue to provide structure while allowing for increasing autonomy. The iterative cycles of assessment, feedback, and corrective procedures inherent in ML enable learners to refine their performance through deliberate practice (Guskey, 2010). Simultaneously, OBE encourages the alignment of assessments with authentic tasks and real-world applications, promoting deeper understanding and transfer of learning (Biggs & Tang, 2011). These mechanisms collectively support the development of strategic thinking, problem-solving skills, and adaptive expertise at the middle stage of development.

At the Expert stage, learners demonstrate independent, flexible, and context-sensitive performance. ML's emphasis on time-for-learning supports high-level performance by allowing learners to consolidate and extend their expertise. On the other hand, OBE provides the framework to articulate complex, higher-order outcomes that characterize expert performance, such as critical thinking, ethical reasoning, and leadership (Harden, 2007). Together, these approaches ensure that assessment and instructional strategies remain aligned with the sophisticated competencies required for expert-level practice, enabling learners to meet the demands of professional and lifelong learning contexts.

In summary, both OBE and ML provide a robust pedagogical foundation that supports learners at all stages of the CBE developmental model. Their shared emphasis on clarity, feedback, and progression ensures that instruction is responsive to learner needs and developmentally appropriate, ultimately leading to high levels of competence and confidence across diverse learning trajectories.

***Theories Supporting Novice Learners at Stage 1***

Cognitive Load Theory aligns with the Novice stage because it provides principles for minimizing extraneous cognitive demands, allowing learners to focus on essential content and skills without being overwhelmed (Chen et al., 2023). This theory informs instructional strategies such as segmenting complex tasks into manageable steps, reducing unnecessary information, and using visual aids or worked examples to support schema construction (van Merrienboer & Sweller, 2005). Assessment practices that align with Cognitive Load Theory prioritize high-frequency, low-stakes assessments that minimize cognitive overload, ensuring that learners can process and retain key information efficiently (Leppink, 2017).

Novices benefit from repetition, reinforcement, and immediate feedback to form foundational concepts and basic skills. Behaviorism complements this by reinforcing desired behaviors through repetition, feedback, and positive reinforcement, which are essential for habit formation and procedural consistency (Goldberg, 2023). Behaviorism identifies drills as highly structured, repetitive exercises focusing on subskills. It provides repeated practice, often with cues or prompts to reinforce and automate correct responses (Goldberg, 2023). Instructional strategies grounded in behaviorism include programmed instruction, guided practice, and performance assessments with clear feedback, for building foundational knowledge and basic skills. These strategies are especially effective when paired with immediate reinforcement (e.g., praise, rewards, or correction), which shapes behavior over time. Assessments in this framework are often performance-based, focusing on observable actions, accuracy, and response time to determine skill acquisition.

Together, these theories inform the design of instructional environments that are highly structured, goal-oriented, and focused on incremental progress while also guiding assessment practices that are formative, cognitive, and behavioral. This integrated approach helps novices gain confidence and competence by progressing through clearly defined learning steps with adequate support.

***Theories Supporting Intermediate Learners at Stage 2***

As learners transition to the Intermediate stage, they begin to require more complex cognitive engagement, metacognitive reflection, and social learning opportunities. At this stage, Deliberate practice, based on Ericsson's framework, supports intermediate learners by emphasizing targeted, repetitive practice accompanied by immediate, specific feedback and successive refinement (Berning et al., 2024; Rajaratnam et al., 2021). Instructional design guided by this theory often includes task breakdowns, coaching or mentorship, and reflection to support iterative improvement, enabling intermediate learners to continually engage in focused practice loops (Berning et al., 2024). Assessment practices focus on tracking progress over time, using rubrics, checklists, and formative performance evaluations that allow learners to monitor and refine their skills systematically.

Intermediate learners thrive on linking new material to what they already know in the Novice stage. Ausubel's Meaningful Learning Theory and Constructivism further enhance the instructional approach at this stage by encouraging learners to connect new knowledge to prior experiences, and develop a deeper understanding (Sexton, 2025). Instructionally, this is reflected in concept maps, problem-based tasks, project-based learning, and inquiry-driven discussions, which help learners synthesize and personalize information (Joshi et al., 2022; Muge & Waiganjo, 2025). Assessment strategies include conceptual assessments, reflective essays, and portfolio-based evaluations that allow learners to demonstrate integration and evolving understanding.

Intermediate learners also benefit from observing and interacting with peers. Social Learning Theory and Social Cognitive Theory posit that learning occurs through observation of models and through social interaction (Nabavi, 2012). Instructional strategies include collaborative learning, peer teaching, and role modeling, where learners not only acquire knowledge but also develop self-efficacy and self-monitoring skills through social interaction and feedback (Martin et al., 2023; Rajaratnam et al., 2021). Assessments in this area may include peer evaluations, group performance assessments, and self-assessment tools, emphasizing the social and reflective dimensions of learning.

Finally, Social Identity Theory reinforces the growing importance of professional identity formation (Korte, 2007). Learners begin to internalize the roles and expectations of their professional community, which can be supported through instructional approaches such as cohort-based learning, mentorship programs, and community of practice models. Assessments may include reflective narratives, professional development plans, or identity-focused interviews that capture the evolving sense of belonging and alignment with disciplinary norms.

Collectively, these theories shape a learning environment that fosters deeper understanding, collaborative engagement, and the ability to transfer and apply knowledge in increasingly complex and socially meaningful contexts. Instructional strategies at the Intermediate stage become more learner-centered, interactive, and authentic, while assessment practices evolve to capture both cognitive growth and professional identity development.

***Theories Supporting Expert Learners at Stage 3***

In the Expert stage, the focus shifts to autonomy, self-regulation, motivation, and the application of knowledge in novel, complex situations. At this level, Deliberate Practice also remains important, but with more self-direction, as experts continue to refine their skills through self-directed, goal-oriented repetition with minimal or no feedback (Berning et al., 2024). However, at this stage, the expert learners often engage in deliberate practice by targeting rare or difficult cases, analyzing performance critically, and iterating. The focus of practice becomes increasingly nuanced, with learners often seeking specialized coaching or utilizing advanced self-assessment tools to enhance their skills. Instructional strategies include complex task design, personalized feedback loops, and longitudinal performance tracking to support sustained growth toward excellence.

Theories that gain prominence at this stage emphasize the psychological, motivational, and reflective dimensions of expertise. Self-Determination Theory emphasizes the importance of autonomy and personal growth (Sawatsky et al., 2022). Instructional environments that support this include self-directed learning pathways, elective specialization modules, and autonomy-supportive coaching. Assessment practices shift toward self-evaluation, goal setting, and personal learning portfolios, allowing learners to take ownership of their learning journey.

Achievement Goal Theory complements this by encouraging learners to pursue mastery-oriented goals, foster resilience, and maintain a lifelong learning mindset (Ross et al., 2022). Instructional strategies include challenging, open-ended tasks, growth-oriented feedback, and reflective goal-setting exercises. Assessment may take the form of narrative evaluations, self-reports of learning goals, and learning impact studies that focus on continuous improvement rather than fixed benchmarks.

The Theory of Planned Behavior introduces a cognitive-behavioral lens that is crucial for experts who must make intentional, strategic decisions in uncertain environments. Among expert learners, decision-making about learning activities is often deliberate and thoughtful. For instance, an expert deciding whether to apply a new knowledge or skill to a new or uncertain situation may weigh the benefit of skill (attitude), professional standards (subjective norms), and confidence (perceived control) (Ajzen, 1985; Ajzen, 1991). Instructionally, this translates into decision-making simulations, scenario-based learning, and exercises in ethical reasoning. Assessment focuses on learners' ability to articulate and justify their decisions, often using case analyses, decision journals, and structured reflections to support their reasoning.

Teunissen's ETR Framework (Experiences-Trajectories-Reifications) aligns well with the Expert stage in CBE by illuminating how deep, context-sensitive learning, identity formation, and engagement with the culture of a profession evolve over time. For instance, at the Expert stage, learners encounter complex, unpredictable, high-stakes scenarios and make fluid, context-sensitive decisions (Experiences);

they move beyond competence to professional identity and navigate career transitions and role expansion (Trajectories); they engage with established standards and tools, critically reflect on and refine them, and recognize that unquestioned reifications can constrain learning (Reifications) (Teunissen, 2015). Instructional strategies grounded in ETR include career trajectory mapping, and professional identity workshops. Assessments involve reflective portfolios, professional development plans, and narrative self-assessments, which help capture the learner's evolving identity and meaning-making processes.

Together, the alignment of these theories at the Expert stage informs a deeply contextualized and learner-driven approach to instructional design and assessment in CBE. By tailoring strategies to the psychological, cognitive, and social characteristics of expert learners, educators can foster sustainable mastery, adaptive expertise, and continued professional growth—outcomes that are central to the long-term goals of CBE. Table 4 illustrates how each theory is aligned with each stage of the three-stage model.

## Step 3. Alignment of CBE Frameworks with the Proposed Three-Stage Model

The proposed three-stage model was created by integrating stage-based models and aligning theories with each stage. Now, the final step for a meta-framework for CBE is aligning CBE frameworks, particularly the CBE Assessment Framework (e.g., Miller's Pyramid of Clinical Competence), Learning Framework (e.g., Bloom's taxonomy), and Evaluation Framework (e.g., Kirkpatrick/Phillips Model for Training Evaluation), with assessment activities across the three-stage developmental model to ensure that assessments are developmentally appropriate and support learners' progression. Focusing on the CBE Assessment Framework, Learning Framework, and Evaluation Framework rather than other frameworks (e.g., Curriculum Development Framework or Implementation Framework) in aligning assessment activities across the three-stage model is crucial for ensuring that the assessment practices directly align with the cognitive, behavioral, and professional development of learners at each stage of learning. These frameworks provide clear, measurable criteria for evaluating learner progress and competence, ensuring that assessments are both meaningful and aligned with the developmental goals of the novice, intermediate, and expert stages. The CBE Assessment Framework focuses on tracking learners' acquisition and application of specific competencies, while the Learning Framework emphasizes the cognitive skills that need to be assessed at each stage. The Evaluation Framework offers a structured approach to evaluating overall performance, encompassing both formative and summative assessments tailored to each stage of learner development. By prioritizing these frameworks, assessments can effectively guide, measure, and support learners as they progress from acquiring foundational knowledge to demonstrating expertise in complex, real-world contexts.

The CBE Assessment Framework includes Miller's Pyramid of Clinical Competence, the Informed Self-Assessment Framework, the Framework for System of Assessment, and the Mager Model for Learning Outcomes. Miller's Pyramid scaffolds

**Table 4**
*Alignment of CBE Theories with the Proposed 3-Stage Model*

| Aligned Stage | Theory | Key Rationale | Instructional Strategy | Expected Outcome |
|---|---|---|---|---|
| Stage 1: Novice | Outcomes-based Education | Ensures all learners acquire essential foundational knowledge and skills required for further learning. | Clear, measurable outcomes to guide instruction on foundational knowledge. | Demonstration of foundational competencies and application of basic knowledge and skills. |
| | Mastery Learning | Ensures foundational knowledge through structured instruction and assessment before progression. | Step-by-step instruction, modular units, formative assessments with remediation. | Clear understanding of basics, mastery of foundational content. |
| | Behaviorism | Reinforces correct behaviors and habits through repetition and rewards. | Guided practice, drill-and-practice, immediate feedback. | Procedural fluency and behavioral consistency. |
| | Cognitive Load Theory | Reduces extraneous load to support working memory and schema development. | Segmenting tasks, visual aids, worked examples. | Efficient processing and retention of core knowledge. |
| Stage 2: Intermediate | Outcomes-Based Education | Aligns competencies with measurable, real-world learning outcomes. | Project-based learning, simulation tasks, performance assessments. | Application and integration of knowledge to practical situations. |
| | Mastery Learning | Ensure learners can demonstrate mastery of integrated, practical skills before moving to advanced tasks. | Scaffolding of instruction, formative feedback, and offer remediation for complex skills | Mastery of intermediate, applied skills and preparation for advanced, independent learning. |

| | | | | |
|---|---|---|---|---|
| | Deliberate Practice | Supports skill refinement through targeted practice and feedback. | Task breakdown, coaching, reflective journaling. | Improved performance through iterative feedback. |
| Stage 2: Intermediate | Meaningful Learning & Constructivism | Encourages deeper understanding via connection with prior knowledge and exploration. | Case-based learning, concept mapping, inquiry discussions. | Conceptual integration and personal meaning-making. |
| | Social Learning Theory & Social Cognitive Theory | Fosters self-efficacy and skill development through observation and interaction. | Collaborative learning, peer teaching, role modeling. | Improved collaboration and self-regulation. |
| | Social Identity Theory | Supports identity development within a professional community. | Mentorship, cohort-based learning, community of practice. | Stronger professional identity and sense of belonging. |
| Stage 3: Expert | Outcomes-Based Education | Prepare learners for professional practice or advanced study through complex tasks. | Capstone projects, internships, real-world problem-solving. | Transferable expertise and workplace readiness. |
| | Mastery Learning | Demonstrate mastery in open-ended, real-world challenges requiring autonomy. | Enrichment, independent inquiry, real-world problem-solving tasks. | Mastery in complex, authentic tasks and transfer of skills to new, unpredictable contexts. |

| | | | | |
|---|---|---|---|---|
| Stage 3: Expert | Deliberate Practice | Supports high-level refinement of skills through self-directed practice. | Advanced coaching, peer benchmarking, longitudinal tracking. | Sustained performance improvement and mastery. |
| | Self-Determination Theory | Enhances intrinsic motivation, autonomy, and personal growth. | Self-directed learning, specialization tracks, autonomy-supportive coaching. | Ownership of learning and lifelong growth. |
| | Achievement Goal Theory | Promotes mastery goals and resil-ience in learning. | Growth feedback, goal-setting, open-end-ed tasks. | Lifelong learning orientation and reflective improvement. |
| | Theory of Planned Behavior | Informs strategic decision-making in uncertain contexts. | Scenario-based learning, ethical reasoning, decision simulations. | Intentional and justified action. |
| | ETR Framework (Teunissen) | Highlights identity development and meaning-making through profes-sional experience. | Career mapping, mentorship, identity workshops. | Professional maturity and purpose-driven engagement. |
| | Constructivism, Meaningful Learning, Social Learning, Social Identity | Promotes co-construction of knowledge and adaptive expertise in collaborative settings. | Collaborative research, interdisciplinary forums, knowledge-sharing. | Adaptive expertise and interdisciplinary integration. |

*Note.* Each theory is aligned with the stage of the proposed 3-stage model (Novice, Intermediate, Expert) to which it is most relevant, recognizing that a theory may inform multiple stages but is placed based on its strongest association.

assessments progressively across all three stages, beginning with knowledge recall for novices and culminating in the assessment of real-world performance for experts. Miller's Pyramid is a hierarchical model of assessment that progresses through four levels: Knows (factual knowledge), Knows How (applied knowledge), Shows How (demonstration of skills), and Does (real-world performance) (La Chimea et al., 2020). For novice learners, the focus is on the Knows and Knows How levels, where assessments center on foundational knowledge and conceptual understanding (Robinson, 2021). These learners benefit from structured and scaffolded evaluations, such as multiple-choice questions and case analyses, that verify their grasp of terminology, concepts, and procedures. At the intermediate stage, learners engage with the Shows How level, demonstrating their competencies in simulated or supervised settings. Assessments such as structured oral exams and simulated tasks align well with learners who are beginning to apply their skills in increasingly authentic contexts (Robinson, 2021). For expert learners, the emphasis shifts to the Does level, where assessment occurs in real-world, complex environments such as clinical rotations, fieldwork, or teaching practice. At this stage, integrated competencies, professional judgment, and contextualized decision-making are evaluated (La Chimea et al., 2020).

The Informed Self-Assessment Framework (ISA) becomes increasingly relevant from the intermediate stage onward, encouraging reflective assessment practices and self-regulation, especially important for expert learners. The ISA emphasizes learners' ability to critically evaluate their own competence by integrating internal self-evaluations with external feedback across contexts and over time (Sargeant et al., 2010). It highlights the importance of metacognition, feedback-seeking, and self-regulation as core processes in learning (Mann et al., 2011; Verma, 2023). Intermediate learners are increasingly able to align their self-perceptions with external standards, using tools such as learning journals, formative peer feedback, and structured mentor or facilitator feedback loops to support the development of self-regulatory skills. For expert learners, ISA is essential. These learners rely on critical reflection, continuous feedback-seeking, and adaptive learning to navigate complex, ill-structured tasks (Sargeant et al., 2010). Mechanisms such as professional portfolios, learning contracts, and peer review enable experts to monitor their growth, set meaningful learning goals, and refine their practice. Instructionally, the ISA framework supports a developmental shift from dependent to autonomous learning by helping learners internalize performance standards and develop habits of lifelong learning that are critical to achieving expert-level competence.

Competency-Based Assessment (CBA) provides a comprehensive structure to align multiple assessment methods with evolving competencies, ensuring assessments are developmentally appropriate, from formative diagnostics at the novice stage to longitudinal performance evaluations for experts (Young et al., 2021). A system of CBA designed according to the principles of coherence, continuity, comprehensiveness, feasibility, purposefulness, acceptability, and transparency aligns effectively with the developmental progression from novice to expert (Young et al., 2021). For novices, frequent, low-stakes, and coordinated assessments build foundational knowledge and confidence within a supportive framework. Intermediate learners benefit from integrated, feedback-rich assessments that track progress and support growing autonomy. At the expert stage, comprehensive and transparent evaluations such as portfolios capture complex, real-world competence, ensuring fair, meaningful, and credible judgments. The system adapts across stages to promote developmentally appropriate, equitable, and purpose-driven assessment.

Mager's Model for Learning Outcomes aligns differently across the developmental stages of novice, intermediate, and expert learners based on its emphasis on clearly defined, performance-based objectives (Winget & Persky, 2022). At the novice stage, the model is highly effective, as learners benefit from explicit behavioral outcomes that guide their learning and practice. Clear objectives detailing the expected behavior, the conditions under which it should occur, and the criteria for success help structure instruction and support early skill acquisition. For intermediate learners, Mager's model continues to offer value, particularly in the development and refinement of discrete sub-skills. However, as learners begin engaging with more complex and integrative tasks, the rigid specificity of the model may need adaptation. It can still be applied to set performance benchmarks in more realistic, authentic contexts that support continued growth. At the expert stage, the model's utility declines, as expert performance often occurs in unpredictable, ill-structured environments where flexibility and judgment are key. Nevertheless, the model can still inform the articulation of high-level expectations by specifying standards for advanced tasks, such as ethical decision-making or methodological rigor. Overall, Mager's model supports developmental alignment by offering clarity and structure early on, with adaptable relevance for more advanced learners.

As the CBE Learning Framework, the revised Bloom's Taxonomy classifies cognitive skills along a continuum of increasing complexity: Remember, Understand, Apply, Analyze, Evaluate, and Create (Krathwohl, 2002). This hierarchy provides a developmental framework that aligns closely with the progression of learners in competency-based education (Ford & Meyer, 2015). At the novice stage, learners engage with the Remember and Understand levels, building foundational knowledge and procedural fluency. Assessments focus on recall and comprehension through multiple-choice questions, short answers, and concept mapping, supported by guided reading and structured discussions. At the intermediate stage, the Apply and Analyze levels become central as learners begin to apply their knowledge in novel contexts and develop problem-solving skills. Assessments shift to performance-based tasks, such as case studies and role-plays, while instruction emphasizes collaborative and scenario-based learning. These assessments track progress and provide actionable feedback to support ongoing improvement. At the expert stage, the focus moves to Evaluate and Create, where learners exercise critical judgment and produce original work in complex, real-world settings. Bloom's revised taxonomy thus provides a developmental framework aligning cognitive demands and assessment practices with learners' progression in competency-based education.

As the CBE Evaluation Framework, the Kirkpatrick/Phillips Evaluation Model provides a five-level framework for assessing the effectiveness of training and educational programs: Reaction, Learning, Behavior, Results, and Return on Investment (ROI) (Cady et al., 2018). This model aligns well with the developmental progression of learners in CBE (Bisgaard et al., 2018). At the novice stage, learners are beginning their learning journey and need to build motivation, confidence, and a solid foundation of knowledge and skills. This makes Kirkpatrick's Level 1 (Reaction) and Level 2 (Learning) especially relevant. Level 1 ensures that the learning environment is engaging and supportive while Level 2 focuses on verifying that learners have acquired the foundational knowledge and skills needed to progress. Learners' satisfaction, motivation, and perceived relevance of the content are assessed through post-session feedback, while foundational knowledge and skills are evaluated using quizzes, demonstrations, and knowledge checks. These assessments support formative feedback, criterion-referenced learning, and early identification of instructional gaps.

As learners reach the intermediate stage, the emphasis shifts to applying and integrating knowledge, aligning with the continued development of Level 2 (Learning) and Level 3 (Behavior). Learners demonstrate deeper understanding and problem-solving through case studies and simulations, while their ability to transfer learning into practice is assessed through peer observations, mentor or facilitator evaluations, and self-reports. This stage supports hybrid formative-summative assessments, emphasizing integration, transfer, and deliberate practice of skills.

At the expert stage, the focus expands to demonstrating impact, aligning with Level 3 (Behavior), Level 4 (Results), and Level 5 (ROI). Experts consistently apply competencies in complex, real-world environments, with assessments evaluating broader outcomes such as team performance, innovation, or quality improvement. The ROI level adds a strategic layer, assessing the value of learning through cost savings, increased efficiency, or improved service outcomes. This stage supports longitudinal, authentic assessments such as portfolios, self-directed projects, and leadership evaluations that capture system-level contributions and sustained professional growth. The model thus offers a comprehensive, developmental framework for evaluating learner progression and instructional effectiveness in competency-based systems.

Overall, each framework makes a unique contribution to the development of assessment practices that evolve with the learner's stage of growth. Together, they provide a structured, theory-informed foundation for designing assessments that are targeted, developmentally appropriate, and supportive of long-term competence and professional identity formation. Table 5 shows how CBE frameworks are aligned with each stage of the 3-stage model.

**Table 5**
*Alignment of CBE Frameworks with Assessment Practices in the Proposed 3-Stage Model*

| CBE Frameworks Aligned with Assessment Practices at Each Stage | Stage 1: Novice | Stage 2: Intermediate | Stage 3: Expert | Rationales |
|---|---|---|---|---|
| CBE Assessment Framework | **Knowledge recall, formative feedback**<br>- Structured quizzes and tests for basic knowledge recall<br>- Formative assessments such as knowledge checks and practice problems<br>- Immediate feedback on tasks<br>- Digital portfolios to track early progress | **Application in simulated tasks, peer/self-assessment**<br>- Simulations and supervised clinical/practical tasks<br>- Practical case scenarios with targeted feedback- Self-assessment and peer assessments<br>- Rubrics for evaluating skill proficiency | **Real-world tasks, portfolio feedback**<br>- Real-world tasks and independent practice<br>- Comprehensive clinical performance reviews (e.g., unsupervised clinical practice)<br>- Multi-source feedback (360° feedback)<br>- Portfolio assessment capturing professional development | Aligning assessments at each stage supports learners' progression from acquiring foundational skills to applying expertise in professional settings. Early stages focus on basic competencies and scaffolded learning, while later stages challenge learners with real-world tasks and independent performance. |
| Learning Framework (Bloom's Taxonomy) | **Remember & Understand**<br>- Quizzes testing recall and comprehension<br>- Basic application tasks, such as simple problem -solving exercises<br>- Flashcards and interactive learning tools | **Apply & Analyze**<br>- Problem-solving tasks requiring application and analysis of concepts<br>- Case studies and scenario-based questions<br>- Group discussions and journal activities to assess synthesis and application of knowledge | **Evaluate & Create**<br>- Advanced case analyses and real-world problem-solving scenarios<br>- Critical thinking exercises that require evaluation and creation of new solutions<br>- Self-reflection journals to assess metacognition and mastery | Bloom's Taxonomy ensures that assessments are developmentally appropriate, beginning with foundational knowledge and progressing to complex, critical thinking and creative problem-solving as learners advance in their abilities. |
| CBE Evaluation Framework | **Learning Level**<br>- Pre/post knowledge assessments (e.g., quizzes, written exams)<br>- Knowledge retention checks (e.g., recall tasks)<br>- Affective outcome rubrics assessing ethical behavior | **Behavior Level**<br>- Mentor ratings of clinical and psychomotor skills (e.g., OSCEs)<br>- Reflective journal analysis for evidence of self-regulation<br>- Peer and instructor assessments of group problem-solving | **Results Level**<br>- Unsupervised performance evaluations (e.g., clinical tasks, leadership roles)<br>- Stakeholder outcome measures (e.g., patient satisfaction, error rates)<br>- Portfolio and multi-source feedback (e.g., 360° assessments) | Evaluations at each stage must align with learners' development. In the early stages, formative assessments track initial learning, while in intermediate stages, summative evaluations capture real-world application, and expert evaluations emphasize comprehensive performance and mastery in professional settings. |

## A Comprehensive Meta-Framework for CBE: A Synthesis

The CBE meta-framework, through the integration of stage-based models, theories, and frameworks, is not a theory in itself. Rather, it is a strategy for using CBE theories, models, and frameworks to identify impediments to change, generate hypotheses about possible timely interventions, and organize tests of both theory and interventions. Thus, the proposed CBE meta-framework is a conceptual and methodological strategy that can be used with any theories that seem appropriate.

The proposed meta-framework is also designed to guide not only classroom-level instructional design but also to support broader system-level changes. By clarifying developmental pathways, assessment strategies, and roles across all levels of implementation, the framework provides a roadmap for integrating both instructional and organizational reforms in a CBE context. Recognizing CBE as a potential catalyst for institutional transformation, this framework can be utilized by school or district leaders undertaking systemic change, facilitating alignment of policies, assessment systems, and instructional practices to support effective competency-based models on a larger scale.

In addition, the goal of the meta-framework is not intended to be relevant to all types of learners' cognition or behaviors but rather is explicitly intended to be relevant to individual development and growth in each stage. Thus, the meta-framework is appropriate for CBE-specific risks or change processes. Figure 2 illustrates the CBE meta-framework that synthesizes and integrates the three different theoretical approaches to CBE.

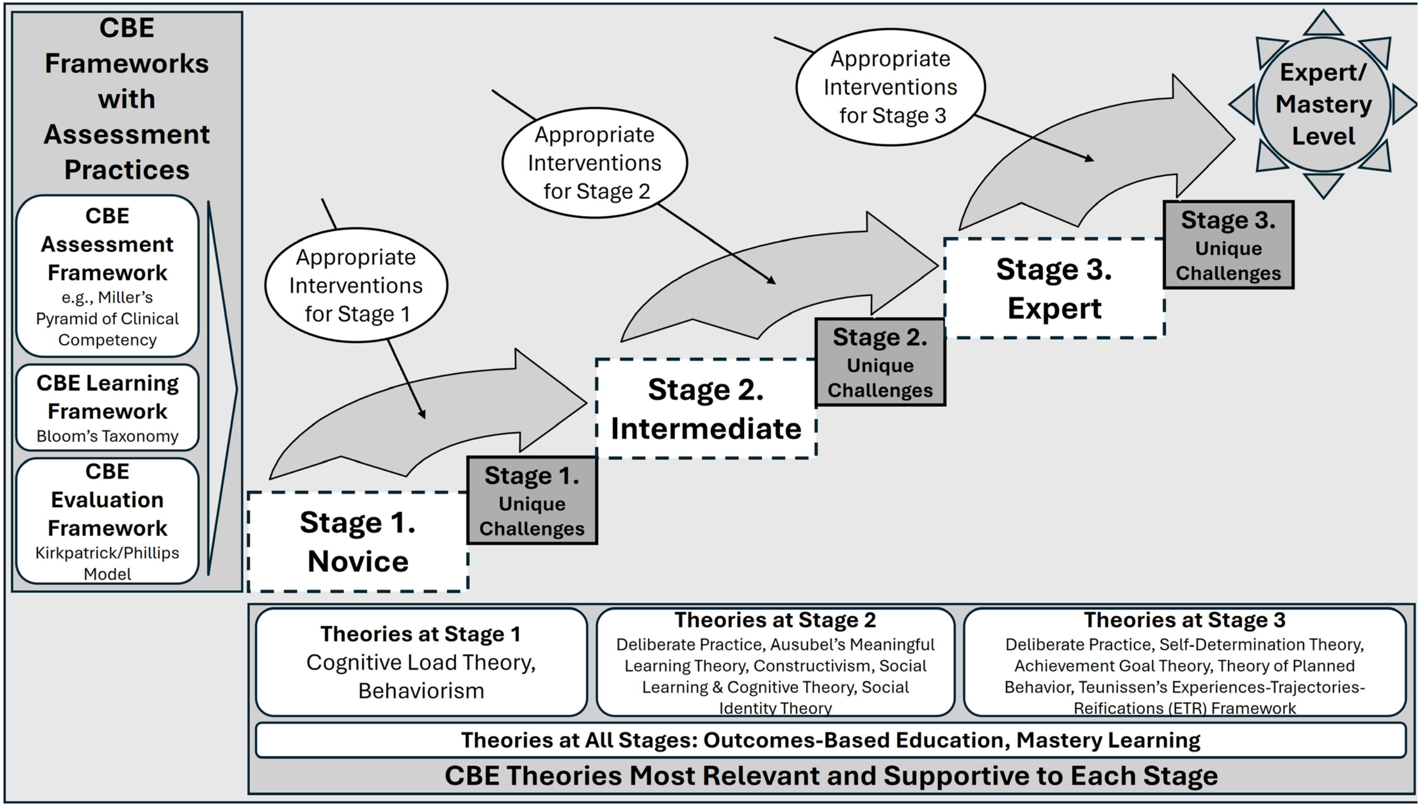
A CBE meta-framework promotes the integration of knowledge about learner readiness, developmental challenges, and the effectiveness of tailored instructional strategies. This alignment enables the creation of a comprehensive, stage-specific and theory-driven learning model that is optimized to produce the most relevant and effective outcomes at each level of learner development (novice, intermediate, and expert). A synthesized CBE meta-framework is founded on the principle that the cumulative benefits of appropriately tailored instructional interventions across stages will lead to stronger long-term learning outcomes.

For instance, interventions at the novice stage may not independently produce long-term performance gains but are essential for building foundational knowledge and motivation. Their value becomes fully evident when followed by stage-appropriate learning strategies at the intermediate stage, such as applied practice and targeted feedback, and eventually by expert-level interventions that foster autonomous performance and reflective competence. The additive or even interactive impact of optimally aligned instructional supports across these developmental stages enhances overall learner mastery.

This CBE meta-framework also assumes that identifying the most effective instructional approaches requires stage-sensitive assessments, both to inform instructional design and to evaluate learning mechanisms. These assessments should undergo robust validation processes, such as construct validation, to ensure they

**Figure 2**

*A Synthesized CBE Meta-Framework*



meaningfully capture learner progress at each stage. Even when optimal strategies are not yet identified for every stage, the CBE stage-based approach ensures that no part of the learner's developmental trajectory is overlooked.

The CBE meta-framework accelerates research and innovation in instructional design regarding CBE. Hypotheses should target the specific cognitive, behavioral, and motivational challenges faced at each stage, and should explore the additive and synergistic effects of instructional methods across the novice-to-expert continuum. Research should also investigate how different instructional strategies interact with learners' developmental needs, and how assessments should be tailored to sensitively detect stage-specific learning gains. This approach not only supports more targeted hypothesis development and evaluation but also facilitates the design and testing of more effective instructional strategies through intentional, evidence-informed alignment with developmental stages. As a result, educators are more likely to create high-impact learning experiences that yield sustained growth in competency and performance outcomes.

While the review of the novice, intermediate, and expert stages demonstrates the promise of this stage-based approach, it also highlights the complexity of evaluation across developmental levels. Ideally, the unique and complementary effects of instructional interventions must be assessed both within each stage and across the entire learner progression. The vast number of instructional components and outcome variables (e.g., knowledge acquisition, performance application, metacognitive development, cost-effectiveness) creates a significant evaluative challenge. What is needed, therefore, is a scalable and systematic strategy for evaluating instructional interventions at each stage, selecting the most promising ones, and testing their combined impact in composite instructional models. These instructional models must be constructed to yield optimal cumulative effects across developmental stages. Furthermore, the effectiveness of interventions may vary depending on which outcome is emphasized, whether it is early knowledge acquisition, long-term performance, or the efficiency of learning, underscoring the need for thoughtful, stage-aligned instructional design and evaluation.

## Conclusions

The present study was designed to develop and synthesize a meta-framework for CBE based on existing theories, models and frameworks, rather than to demonstrate its direct application in specific real-world settings. As such, this study does not include empirical examples of the framework in use. Nevertheless, the proposed meta-framework offers a structured basis for future research and practical exploration. It is intended to guide subsequent studies and the work of educators or policymakers seeking to map developmental trajectories, select appropriate interventions, or design assessments tailored to different stages of learner progression in CBE.

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## Appendix: Reference Lists for the 36 Articles Included in the Review

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