*Article*

# Construction and Practice of an OBE-Oriented Virtual Simulation Teaching Model for Continuing Education

**Wenjie Jia**[1,*]

[1] Chongqing College of Architecture and Technology, Chongqing, China
* Correspondence: Wenjie Jia, Chongqing College of Architecture and Technology, Chongqing, China

**Abstract:** Adult learners often experience challenges in balancing employment, family responsibilities, and participation in practical training. Virtual environments can improve access to professional learning, but technology alone cannot guarantee occupational competence. This study constructs an outcome-oriented instructional model by integrating constructive alignment, adult learning, experiential learning, and competency-based assessment. A design-oriented approach is adopted to analyze instructional problems, specify expected achievements, organize authentic scenarios, and establish an evidence-based evaluation mechanism. The model comprises needs analysis, achievement specification, progressive learning activities, multidimensional assessment, and continuous improvement. Its application is illustrated through a professional skills course involving preparation, guided exploration, repeated operation, problem solving, reflection, and transfer. Operational records, task products, decision explanations, reflective reports, and workplace-related assignments are used as complementary evidence. The proposed model can improve instructional flexibility, learner engagement, occupational relevance, and alignment between curriculum expectations and professional performance. It also provides a practical reference for the digital transformation of continuing vocational education.

**Keywords:** adult learners; constructive alignment; experiential learning; competency assessment; digital pedagogy; formative feedback; workplace transfer

## 1. Introduction

Continuing education is an important component of lifelong learning, professional development, vocational qualification, and workforce transformation. Rapid technological development and industrial restructuring require employees to update their knowledge and skills throughout their careers. Competencies acquired at the beginning of employment may become insufficient when production systems, occupational standards, digital tools, and organizational practices change. Vocational colleges and other educational institutions are therefore expected to provide accessible and effective learning opportunities for adults who need to improve their professional competence without leaving employment for an extended period.

Adult learners study under conditions that differ from those experienced by full-time students. They must balance learning with employment, family responsibilities, commuting, and social obligations. Their available learning time is often fragmented, and participation may be interrupted by temporary work assignments or changes in working schedules. Learners in the same course may also differ substantially in educational background, occupational experience, motivation, digital literacy, and confidence.

Some adult learners possess extensive workplace experience but lack systematic theoretical knowledge. Others understand relevant concepts but have limited opportunities to perform authentic professional tasks. A uniform instructional sequence may therefore be unnecessarily repetitive for experienced participants and too difficult for learners with weak prerequisite knowledge. Continuing education consequently

Received: 03 September 2026
Revised: 16 October 2026
Accepted: 27 October 2026
Published: 31 October 2026

**Copyright:** © 2026 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

needs a flexible instructional arrangement that combines common performance standards with differentiated support.

Practical instruction presents particular difficulties. Many professional courses require learners to operate equipment, interpret technical information, identify hazards, diagnose faults, implement standard procedures, and make decisions under realistic constraints. These abilities cannot be developed adequately through lectures, textbook reading, and written examinations alone. Learners need opportunities to perform meaningful tasks, observe consequences, receive feedback, reflect on errors, and improve their performance.

Conventional practical instruction is frequently limited by equipment availability, fixed laboratory schedules, high material costs, safety risks, environmental requirements, and insufficient instructor time. A physical device may need to be shared by many learners, making repeated and independent operation difficult. Dangerous, unusual, or costly incidents cannot be reproduced simply for instructional purposes. As a result, learners may remember factual knowledge and normal procedures without developing the ability to respond to complex or abnormal occupational situations.

Virtual simulation technology provides a possible response to these limitations. It can represent equipment, procedures, workspaces, information flows, and professional decisions through an interactive environment. Learners can access activities at a suitable time, repeat difficult procedures, observe system responses, and explore the consequences of alternative actions without damaging expensive equipment or creating an actual safety incident.

Digital platforms can also record operational sequences, completion time, repeated attempts, prompt use, common errors, and correction behavior. These records provide information that may be difficult to collect in a conventional classroom. When interpreted appropriately, they can support personalized guidance, formative assessment, and instructional improvement.

Nevertheless, the adoption of technology does not automatically improve learning. In some courses, a virtual environment is treated primarily as a visual demonstration. Learners follow highlighted instructions, click controls in a predetermined sequence, and receive a completion score without understanding the principles behind their actions. In other cases, visual realism and technical novelty receive greater attention than professional competence.

Platform-generated scores may represent only behavior that is easy to measure. A system can record whether a learner selected the correct control or completed a procedure within a specified time, but it may not adequately evaluate diagnostic reasoning, safety awareness, professional responsibility, communication, or the ability to apply learning in a new context. If a completion score is treated as complete evidence of competence, the validity of assessment will be limited.

Outcome-Based Education provides a useful direction for addressing these problems. It begins by identifying what learners should be able to demonstrate at the end of an educational experience. Course content, activities, resources, assessment, and improvement measures are then organized around those expected achievements. Spady emphasized that educational systems should be designed backward from significant outcomes rather than being driven mainly by instructional time and content coverage [1].

The central question in an outcome-oriented course is not whether the instructor has presented every textbook chapter. The more important question is whether learners can apply knowledge, complete procedures, solve authentic problems, justify decisions, and transfer relevant principles to professional settings. This emphasis is especially appropriate for continuing education because adult learners generally value instruction that is relevant, efficient, flexible, and connected with workplace needs.

Integrating outcome orientation with virtual simulation can strengthen the relationship among expected achievements, learning activities, and assessment. Clearly expressed achievements help learners understand the purpose of each activity. Interactive scenarios provide opportunities for repeated practice and problem solving. Digital

records support targeted feedback, while reflection and transfer prevent learning from being reduced to mechanical platform operation.

However, technology and curriculum are frequently developed separately. Some projects focus on platform construction without explaining how professional requirements are translated into observable achievements. Other projects emphasize general educational principles but provide insufficient guidance on scenario design, performance assessment, and continuous improvement. A coherent model connecting professional needs, intended achievements, learning tasks, assessment evidence, and curriculum revision is therefore necessary.

This study has three objectives. First, it explains the theoretical basis for integrating outcome orientation with interactive digital learning in continuing education. Second, it constructs a model comprising achievement specification, scenario-based learning, multidimensional assessment, and continuous improvement. Third, it illustrates the application of the model through a representative professional skills course.

The study adopts a design-oriented approach. It does not invent participant numbers, questionnaire results, examination scores, or statistical findings. Instead, it develops a theoretically informed model and practical application that can provide a basis for subsequent empirical research.

## 2. Theoretical Basis and Research Design

### *2.1. Outcome Orientation and Constructive Alignment*

Outcome-Based Education requires curriculum development to begin with a clear description of what learners are expected to accomplish. An outcome is not merely a statement of the content an instructor intends to present. It describes an observable and meaningful performance through which learners demonstrate integrated knowledge, skills, judgment, and professional attitudes.

Two principles are central to outcome orientation. The first is clarity of focus. Teachers and learners should understand the expected achievements, the criteria used to judge performance, and the relationship between learning activities and those achievements. Clear outcomes help instructors select relevant content and allow learners to recognize the purpose of each task.

The second principle is backward design. Instead of selecting teaching content first and determining assessment at the end, curriculum designers identify the desired achievements, specify the evidence required to demonstrate them, and then organize activities that prepare learners to produce the required evidence. This process strengthens the connection among occupational needs, course expectations, learning activities, and assessment.

Constructive alignment provides a related curriculum perspective. Biggs argued that learners construct meaning through relevant activities and that intended outcomes, learning activities, and assessment tasks should be systematically aligned [2]. If a course expects learners to diagnose a complex professional problem but assesses only their ability to recall definitions, the curriculum is not aligned. Similarly, if operational competence is expected but learners only watch demonstrations, the activities do not provide sufficient opportunities to develop the intended performance.

Alignment in continuing education should be considered at several levels. Program outcomes should correspond with occupational standards, social needs, and institutional goals. Course achievements should contribute to the program outcomes. Individual tasks should support course achievements, while assessment should produce credible evidence of learner performance. The resulting evidence should inform learner guidance and course improvement.

Outcome orientation does not require professional learning to be reduced to isolated mechanical behavior. Professional competence frequently includes reasoning, communication, collaboration, ethical responsibility, and adaptation to uncertainty. These qualities can be represented through carefully developed performance statements.

A meaningful achievement statement should specify an observable action, a relevant condition, and an expected standard of quality. For example, the statement that learners will understand equipment operation is too broad to guide instructional design. A more useful statement would require learners to complete a standard operating sequence in a representative scenario, explain the purpose of critical steps, identify unsafe conditions, and correct errors according to relevant requirements.

Clear achievement statements also help control excessive course content. Continuing education courses often attempt to cover large amounts of information within a limited period. Outcome orientation encourages designers to identify the concepts, procedures, and standards necessary for professional performance. Supplementary information can be provided as optional material rather than being allowed to obscure essential learning requirements.

*2.2. Adult and Experiential Learning*

Adult learning is affected by prior experience, professional roles, immediate needs, and personal responsibilities. Adults often participate more actively when they understand why an activity is important and how it relates to a workplace problem. Activities that appear disconnected from practical needs may result in superficial participation.

Learner diversity must also be recognized. A continuing education class may include experienced technicians, managers, career changers, newly employed workers, and people returning to formal study after many years. Their theoretical preparation, practical experience, digital skills, and confidence may vary considerably. Diagnostic activities, optional support, repeated practice, and flexible access are therefore necessary.

Prior experience can be a valuable instructional resource. Experienced participants may contribute authentic cases and compare new principles with workplace practice. However, experience does not always represent appropriate or current practice. Learners may have developed habits inconsistent with updated occupational standards. Instruction should enable participants to examine existing assumptions and compare familiar routines with formal requirements.

Experiential learning provides an important theoretical basis for practical instruction. Kolb described learning as a cycle involving concrete experience, reflective observation, abstract conceptualization, and active experimentation [3]. An interactive environment can support this cycle when learners perform meaningful tasks, observe consequences, interpret feedback, develop explanations, and attempt improved strategies.

Digital operation alone does not constitute experiential learning. A learner who follows highlighted controls may complete an activity without developing an internal understanding of the process. A meaningful experience requires a task goal, relevant information, decisions, consequences, feedback, and reflection.

Instructional support should change as learners progress. Early activities may include demonstrations, highlighted information, and step-by-step prompts. Later tasks should gradually remove these supports and require learners to identify relevant information independently. If prompts remain available throughout the course, learners may become dependent on the platform.

Scenario variation is equally important. Repeating an identical sequence may improve familiarity with the interface without improving adaptability. Later scenarios should modify operating conditions, available information, task constraints, or fault patterns. Learners must determine which principles remain applicable and which procedures need adjustment.

Professional knowledge is also connected with the context in which it is used. Occupational performance involves recognizing information, coordinating tools and people, following standards, managing constraints, and responding to uncertainty. Scenario-based activities can represent these contextual features more effectively than isolated factual questions.

A virtual environment nevertheless remains a representation rather than the workplace itself. It may simplify sensory information, interpersonal communication, environmental uncertainty, and organizational culture. Learners should understand both the similarities and differences between digital scenarios and actual professional conditions.

Transfer is more likely when learners encounter varied cases, explain decisions, reflect on errors, and connect virtual tasks with physical or workplace assignments. The goal is not merely to help learners complete one platform sequence but to develop understanding that can be applied to new professional situations.

*2.3. Research Approach*

This study adopts a design-oriented research approach. Its purpose is to construct a theoretically informed and practically usable instructional model rather than claim a statistical treatment effect. This approach is suitable for addressing an authentic educational problem through the development and refinement of a systematic intervention.

The research process involved four activities. First, common problems in continuing education were analyzed, including fragmented learning time, learner diversity, limited equipment access, insufficient repeated practice, safety constraints, and weak alignment between assessment and occupational competence.

Second, relevant perspectives were synthesized. These included outcome orientation, constructive alignment, adult learning, experiential learning, competency assessment, and formative feedback. The synthesis produced principles that could guide course design.

Third, these principles were translated into an integrated model connecting professional needs, intended achievements, learning activities, digital scenarios, assessment evidence, and continuous improvement. Fourth, a representative professional skills course was used to illustrate the model's application.

Six design principles were established. Intended achievements should be observable and assessable. Learning activities and assessment should correspond with those achievements. Scenarios should represent the functional logic of professional practice. The learning process should accommodate learner diversity. Assessment should use multiple forms of evidence. Evidence should support course improvement as well as individual evaluation.

The model draws on occupational documents, learner information, instructional evidence, and stakeholder feedback. Occupational standards and job requirements help determine what learners need to accomplish. Learner characteristics support differentiated design. Task records and products provide evidence of performance, while feedback from teachers, learners, technical staff, and professional experts supports course evaluation.

Because this is a design-oriented study, it does not report an institution-specific experimental dataset. This avoids presenting hypothetical figures as empirical results. Institutions implementing the model should collect actual performance records, learner feedback, and transfer evidence in accordance with appropriate ethical requirements.

## 3. Construction of the Integrated Teaching Model

*3.1. Needs Analysis and Achievement Specification*

The model begins with an analysis of occupational requirements and learner needs. Occupational analysis examines professional standards, work procedures, representative tasks, common errors, safety requirements, and difficult situations. Consultation with experienced practitioners can help identify critical incidents that should be included in the curriculum.

Learner analysis examines prior education, professional experience, digital access, available study time, motivation, and support needs. Its purpose is not to construct a single average learner profile but to identify meaningful differences that influence course

design. Experienced participants may require advanced cases, while learners with weak prerequisites may need additional preparation.

Resource analysis identifies available platforms, devices, networks, technical support, physical facilities, teacher capacity, and financial constraints. An advanced platform has limited educational value if learners cannot access it reliably. Risk analysis also considers accessibility, technical failure, data protection, and possible misconceptions created by simplified digital representations.

The results of these analyses are translated into intended achievements. The achievements can be organized into four dimensions. Conceptual achievements require learners to explain principles, relationships, and standards. Operational achievements require accurate and safe completion of procedures. Problem-solving achievements require evidence collection, diagnosis, comparison of alternatives, and decision justification. Professional achievements include communication, documentation, responsibility, and reflection.

These dimensions should not become isolated categories. An authentic professional task frequently requires their integration. Responding to an abnormal technical condition, for example, may require conceptual understanding, operational accuracy, diagnostic reasoning, safety awareness, and professional documentation.

After the achievements have been specified, designers construct an alignment map connecting the achievements with activities, resources, evidence, and criteria. The overall structure of the proposed model is presented in Table 1.

**Table 1.** Structure and Alignment of the OBE-Oriented Virtual Simulation Teaching Model

Component Main design question Principal activities Expected outputs and evidence

Needs analysis What occupational and learner needs should be addressed? Occupational task, learner, resource, and risk analyses Professional task map, learner profile, and prioritized needs

Achievement specification What should learners be able to demonstrate? Development of conceptual, operational, problem-solving, and professional achievements Achievement statements, performance standards, and alignment map

Scenario-based learning What activities can develop the expected performance? Preparation, guided exploration, repeated operation, problem solving, reflection, and transfer Task records, products, decision explanations, and reflective reports

Competency assessment What evidence demonstrates achievement? Process assessment, independent performance, rubric evaluation, and transfer tasks Performance levels, achievement judgments, and feedback

Continuous improvement How should evidence guide curriculum revision? Error analysis, learner feedback, teacher review, and targeted redesign Improvement records, revised resources, and updated scenarios

As shown in Table 1, the model begins with professional and learner needs rather than with a digital platform. Technology is selected only after the educational problem and expected achievements have been clarified. This sequence prevents technical functions from determining curriculum objectives.

The alignment map also prevents two common problems. The first is an achievement without sufficient learning support. If learners are expected to diagnose faults but only practice normal procedures, diagnostic competence cannot reasonably be expected. The second is an activity without a meaningful achievement. A visually attractive task that contributes little to professional performance should be simplified, revised, or removed.

### *3.2. Scenario-Based Learning Process*

The learning process integrates preparation, guided exploration, progressive performance, reflection, and transfer. These elements form a connected cycle rather than numerous independent stages.

Preparation begins with a short diagnostic activity. Learners identify what they already know and what support they require. Essential principles, standards, and safety

requirements are provided through concise resources such as short lectures, diagrams, checklists, and worked examples. Each resource should be directly connected with an upcoming task.

Orientation introduces the purpose of the scenario, expected achievements, interface functions, assessment criteria, and limitations of the digital representation. Learners should receive a low-stakes opportunity to become familiar with the controls. This prevents interface difficulty from being mistaken for a lack of professional competence.

Guided exploration allows learners to investigate the environment, identify important information, and observe functional relationships. Early activities may provide prompts or explanations, but support should be reduced gradually. Later activities should require learners to select information, plan operations, and make independent decisions.

Performance activities progress from routine procedures to abnormal and complex situations. Routine tasks help learners develop accuracy and fluency. Abnormal situations require information collection, diagnosis, comparison of possible responses, and decision justification. Before the outcome of a critical decision is revealed, learners may be required to record the reason for their choice. This reduces random trial and error and makes reasoning visible.

Collaborative analysis can be included when expected achievements involve communication or multiple professional perspectives. Learners may examine an incident, distinguish symptoms from underlying causes, and prepare a group response. Workplace experiences can be introduced, but claims should be compared with relevant principles and standards.

Reflection follows performance. Learners review their actions, errors, feedback, and outcomes. They identify what information influenced a decision, why an error occurred, and what should change in the next attempt. Reflection connects specific virtual experiences with general professional knowledge.

Transfer activities require learners to apply relevant principles to a changed scenario, written case, workplace problem, physical task, or improvement proposal. The new task should differ sufficiently from previous exercises to determine whether learners understand the underlying logic rather than merely remembering an operating sequence.

Each scenario should include a learner role, task goal, initial information, available tools, constraints, critical decisions, and meaningful consequences. Functional authenticity is more important than visual complexity. A simple environment requiring meaningful judgment may be more valuable than a highly realistic environment requiring only passive observation.

Error design is also important. A digital environment allows learners to explore the consequences of inappropriate actions without causing real harm. Feedback should explain why an action is inappropriate and identify the relevant principle. Errors involving critical safety requirements should receive clear and immediate attention.

### *3.3. Assessment and Continuous Improvement*

Assessment begins when achievements are specified rather than after learning activities have been completed. Designers determine in advance what evidence would demonstrate each achievement and how that evidence should be judged.

Multiple forms of evidence are necessary because professional competence is multidimensional. A platform record may show which action occurred but not explain why it occurred. A written response may show conceptual knowledge but not operational fluency. A reflective report may demonstrate awareness but cannot replace actual performance.

Appropriate evidence may include prerequisite checks, task records, learner products, abnormal scenario responses, written or oral explanations, professional documentation, collaborative analysis, reflective reports, and transfer assignments. Physical or workplace verification should be added when the intended competence cannot be adequately represented digitally.

Feedback should be timely, specific, and actionable. Automated feedback is useful for clearly defined procedural errors. Instructor feedback is more suitable for diagnostic reasoning, professional judgment, and transfer. Peer feedback can support collaborative learning when learners use explicit criteria.

Continuous improvement begins by organizing evidence according to intended achievements. An overall score may conceal important patterns. Learners may perform well in routine procedures but poorly in fault diagnosis or transfer. Analysis by achievement allows the instructional team to identify specific weaknesses.

If many learners experience the same difficulty, the cause may lie in the course rather than in learner effort. Preparatory material may omit an essential concept, support may be withdrawn too quickly, the scenario may provide insufficient information, or the interface may create unnecessary difficulty.

Improvement should follow a documented cycle of evidence collection, problem diagnosis, targeted revision, and subsequent review. A course improvement record can identify the problem, supporting evidence, probable cause, planned revision, responsible person, and expected result. Evidence from the next instructional cycle can then be used to determine whether the revision was effective.

## 4. Practical Application and Assessment

### *4.1. Course Context and Activity Organization*

The application presented in this study concerns a representative professional skills course involving the operation, monitoring, and troubleshooting of a technical process system. The example is described at a general level so that its design logic can be adapted to construction, engineering, manufacturing, laboratory, safety, and other vocational fields.

The target participants are employed adults studying part time. Their professional experience and theoretical preparation differ. The physical training system is expensive, and incorrect operation may damage equipment or create safety risks. Access to the laboratory is also limited by location, schedules, and equipment capacity.

The previous instructional arrangement mainly consisted of classroom explanations, videos, teacher demonstrations, and a short physical practice session. Learners could become familiar with basic concepts but had limited opportunities to operate the system repeatedly or independently. They often found responding to abnormal conditions more difficult than recalling the normal operating sequence.

The redesigned module therefore emphasizes system understanding, safe operation, fault diagnosis, decision justification, professional documentation, and transfer. At the end of the module, learners should be able to explain functional relationships, complete standard procedures, recognize unsafe conditions, diagnose representative faults, justify their decisions, produce appropriate operational records, and apply relevant principles to a changed case.

Before the main activities, learners complete a diagnostic check and review concise materials on system principles, standards, risks, and common faults. Learners with sufficient prerequisite knowledge can proceed directly, while those with identified gaps use supplementary resources.

The first digital activity introduces the environment and normal operating sequence. Prompts explain important information and the purpose of critical steps. Learners can pause, inspect component relationships, and repeat the procedure.

The second activity removes some prompts and changes minor operating conditions. Learners decide what information is relevant and select the next action. When an inappropriate action is selected, feedback explains the underlying principle. Learners then revise their approach.

The third activity introduces an abnormal condition. Learners gather evidence, identify possible causes, select a response, and record the reason for the decision before viewing the outcome. A collaborative case discussion follows, allowing participants to

compare interpretations and examine the relationship between workplace experience and formal standards.

Learners then complete an independent scenario without step-by-step prompts. The system records operational sequences, support use, errors, and correction behavior. Learners also submit a short explanation of their critical decisions.

After the independent task, learners compare their performance with the assessment criteria. They identify a successful strategy, an important error, the cause of that error, and an action for improvement. Finally, a changed scenario or workplace-related case is used to evaluate transfer.

The digital activity is not intended to replace all physical learning. Its purpose is to prepare learners, expand opportunities for repetition, represent unusual or risky situations, and support reflection. Physical or workplace practice remains necessary when competence depends on tactile information, interpersonal interaction, or equipment-specific behavior.

*4.2. Multidimensional Assessment*

The assessment framework follows the principles of alignment, authenticity, multiplicity, transparency, and developmental use. Each assessment task should correspond with an intended achievement. Tasks should resemble meaningful professional performance, use several forms of evidence, apply criteria communicated in advance, and support learner improvement.

A balanced assessment portfolio may include prerequisite knowledge checks, guided activity records, independent performance, responses to abnormal situations, decision explanations, professional documentation, reflective review, and a transfer assignment. Guided activities should carry limited weight because learners receive substantial assistance. Independent and transfer tasks should receive greater emphasis.

The principal assessment dimensions are presented in Table 2, which connects each dimension with its evidence, criteria, and function.

**Table 2.** Dimensions, Criteria, and Evidence for Learning Achievement Assessment

Assessment dimension Main evidence Core evaluation criteria Assessment function

Conceptual understanding Knowledge checks, explanations, and principle-based questions Accuracy, clarity, and understanding of relationships Diagnostic and formative

Operational performance Platform records, observation, and completed procedures Correct sequence, accuracy, efficiency, and appropriate tool use Formative and summative

Safety awareness Responses to hazards and behavior in critical situations Hazard identification, compliance, and corrective action Essential competency threshold

Diagnostic reasoning Fault analysis, decision reports, and oral explanations Evidence use, cause identification, comparison, and justification Formative and summative

Professional communication Operational records, group products, and reports Completeness, clarity, accuracy, and professional format Formative and summative

Reflection and transfer Reflective reports, changed scenarios, and workplace assignments Self-evaluation, improvement planning, and application in a new context Summative and developmental

As indicated in Table 2, professional performance includes more than procedural accuracy. Safety awareness, reasoning, communication, reflection, and transfer must also be considered. A learner who completes a procedure quickly but violates a critical safety requirement should not be judged competent simply because performance in another dimension compensates for the violation.

A rubric may describe four performance levels: exemplary, proficient, developing, and insufficient. Descriptors should focus on observable qualities. An exemplary diagnostic response may integrate multiple sources of evidence, distinguish symptoms from causes, justify the selected response, and anticipate consequences. A developing response may identify a possible cause but rely on incomplete evidence.

Minimum thresholds can be established for safety, independent operation, and transfer. Reassessment should be available when appropriate. Learners who initially fail to meet a standard should receive feedback and complete a comparable but different task to demonstrate improvement.

Digital records should be interpreted cautiously. A short completion time may indicate proficiency, guessing, or superficial participation. Repeated attempts may indicate productive persistence or random trial and error. Trace data should therefore be interpreted together with explanations, task products, reflective reports, and transfer performance.

Automated scoring is suitable for clearly defined actions but should not replace professional judgment when a task involves reasoning, communication, or contextual decisions. Instructors should be able to review original performance evidence and revise automated judgments when necessary.

### *4.3. Roles and Implementation Conditions*

The instructor acts as curriculum designer, facilitator, diagnostician, and evaluator. Before instruction, the instructor works with technical staff and professional experts to specify achievements, develop scenarios, and establish assessment criteria. During instruction, the instructor monitors learning, identifies misconceptions, provides guidance, and interprets performance evidence. After instruction, the instructor analyzes results and coordinates improvement.

Teachers require more than technical platform skills. They need knowledge of task design, scaffolding, feedback, assessment, learning analytics, accessibility, and privacy. Institutions should provide professional development and recognize the workload involved in scenario development and evidence analysis.

Learners are active participants. They prepare before entering the scenario, make decisions, review consequences, seek feedback, and revise their performance. Prior experience is treated as a resource, but learners are also encouraged to question habitual practices.

Learner autonomy should be supported by clear structure. Flexible access does not mean the absence of deadlines, milestones, or guidance. Adult learners require concise instructions, progress indicators, technical support, and regular instructor communication.

Reliable infrastructure is a basic implementation condition. Platforms should be tested on devices commonly used by learners. Low-bandwidth alternatives should be considered where necessary, and technical support should be available during the periods when adult learners are likely to study.

Accessibility should be incorporated from the beginning. Readable text, captions, keyboard operation, clear visual presentation, and alternatives to exclusively visual or auditory information can reduce unnecessary barriers.

Institutions also need clear responsibility for platform maintenance, content updating, data protection, quality review, and intellectual property. Without continuing organizational support, an initially effective project may become unusable when software, equipment, or occupational standards change.

Digital records should be collected only for legitimate educational purposes. Learners should know what information is recorded, why it is used, who can access it, and how long it will be retained. Automated assessment should remain subject to instructor review, especially when professional judgment is involved.

## 5. Discussion

### *5.1. Educational Value*

The proposed model responds to adult learner needs by combining flexibility with a clear instructional structure. Digital access reduces dependence on fixed locations and schedules. Repeated activities allow learners with different starting points to progress at

an appropriate pace. Explicit achievements make the purpose of learning visible, while scenarios connect conceptual knowledge with professional decisions.

The model also supports standardization and personalization. Intended achievements and rubrics establish common performance expectations. Diagnostic preparation, optional resources, repeated attempts, and targeted feedback provide differentiated support. Standards define the expected destination, while differentiated assistance provides multiple routes toward it.

Repetition has particular value in practical learning. In a conventional laboratory, learners may have only one opportunity to perform a procedure. An interactive environment allows them to review errors and attempt improvement. Simulation-based instruction can support learning when practice, feedback, curriculum integration, and task variation are appropriately designed [4].

However, repetition should include reflection and changing conditions. Repeating the same procedure may strengthen memory without improving adaptability. Variable cases require learners to identify relevant principles and adjust their actions.

The model places reasoning at the center of operational learning. Requiring learners to explain critical decisions helps instructors distinguish understanding from guessing. It also enables learners to connect actions with consequences and principles. This relationship is particularly important in high-risk settings where correct behavior must remain reliable when conditions change.

Feedback is essential to this process. Effective feedback helps learners understand expected performance, evaluate current progress, and identify the next action required for improvement [5]. Feedback is most useful when learners have an opportunity to apply it in a subsequent attempt.

The model also supports evidence-informed curriculum management. Digital records, learning products, explanations, reflections, and transfer assignments create a broader evidence base than a single examination. When evidence is organized according to intended achievements, instructors can identify specific weaknesses and implement targeted revisions.

### *5.2. Challenges and Limitations*

High-quality scenario development requires time, professional knowledge, technical expertise, and financial resources. Instructors must analyze occupational tasks, develop achievement statements, create scenarios, prepare feedback, construct rubrics, test the environment, and interpret evidence. Sustainable implementation is unlikely if institutions treat this work as an unsupported individual responsibility.

Multidisciplinary cooperation can reduce this burden. Subject specialists ensure professional accuracy, instructional designers support alignment, technical personnel implement platform functions, and evaluation specialists assist with assessment. Modular scenarios and reusable resources can also reduce future development costs.

Technology access remains a potential source of inequality. Some learners may use older devices, unstable networks, or shared computers. Others may have limited digital confidence or accessibility needs. Orientation, low-bandwidth alternatives, technical support, and accessible design are therefore educational requirements rather than optional services.

A further limitation concerns fidelity. A digital representation cannot reproduce every sensory, interpersonal, environmental, and organizational feature of professional work. Digital performance should not automatically be treated as evidence of complete occupational qualification. Physical or workplace verification remains necessary when these dimensions are essential.

The framework is general and requires adaptation to different disciplines. Construction management, equipment operation, safety training, and business decision making involve different forms of authenticity and evidence. The general principles may remain stable, but scenarios and assessment criteria must reflect subject-specific requirements.

The present study is also limited by its design-oriented nature. It does not report controlled experimental findings. The course application demonstrates instructional logic but does not establish a causal effect. This limitation is addressed by avoiding invented statistical data and identifying directions for subsequent empirical evaluation.

*5.3. Implications for Practice and Research*

Institutions should begin with a limited but meaningful pilot module. The selected module should involve an important practical task that is difficult to teach adequately through existing methods. It should have clear professional standards and sufficient teacher commitment.

Technology should be selected after the instructional problem and intended achievements have been defined. Selecting a platform first may result in activities being organized around available technical functions rather than educational needs.

Before implementation, the development team should prepare an evidence plan specifying expected achievements, evidence sources, assessment criteria, privacy procedures, and improvement decisions. Collecting large amounts of digital data without clear educational questions increases workload and privacy risks.

Future empirical studies can use mixed methods. Quantitative evidence may include actual achievement levels, error reduction, course completion, retention, and transfer. Qualitative evidence may include interviews, observations, reflective reports, and instructor analysis.

Comparative studies can investigate different levels of scaffolding, feedback timing, scenario variation, and combinations of digital and physical activity. Longitudinal studies can examine whether participants apply relevant principles several months after course completion and whether workplace supervisors observe changes in professional performance.

Further research should examine the relationship between technical fidelity and educational effectiveness. Greater visual realism may increase development costs without improving achievement. Functional fidelity may be more important when the objective is to understand relationships, make decisions, and observe consequences.

Equity should remain an important research concern. Adult learners differ in educational background, language, disability, professional experience, and digital access. The success of instructional innovation should be judged not only by average performance but also by whether different learner groups can participate and benefit.

## 6. Conclusion

Continuing education requires instructional arrangements that accommodate the limited time and diverse backgrounds of adult learners while maintaining the quality of practical and professional learning. Virtual simulation technology can expand access, support repeated practice, and represent costly, rare, or dangerous situations. Its educational value, however, depends on systematic curriculum design.

This study constructed an integrated model connecting professional needs, intended achievements, scenario-based activities, competency assessment, feedback, and continuous improvement. The model begins with occupational and learner needs analysis. Professional requirements are translated into conceptual, operational, problem-solving, and professional achievements.

Learning activities are organized through preparation, guided exploration, progressive performance, reflection, and transfer. Scaffolding supports initial participation and is gradually reduced as learners become more independent. Scenario variation prevents learning from being limited to memorizing a fixed sequence.

The assessment system combines operational records, learning products, decision explanations, professional documentation, reflective reports, and transfer assignments. Digital trace data are treated as useful indicators rather than complete representations of competence. Essential dimensions such as safety and independent performance can be established as minimum thresholds.

Evidence serves two purposes. It supports judgments about learner achievement and provides information for curriculum improvement. Common difficulties are examined in relation to content, task design, scaffolding, interface functions, and assessment criteria. Targeted revisions are documented and reviewed in subsequent instructional cycles.

The practical application demonstrates how the model can support professional learning without reducing instruction to platform completion. Its principal contribution is the alignment among occupational expectations, course achievements, learning activities, assessment evidence, and continuous improvement.

Sustainable implementation requires qualified instructors, multidisciplinary cooperation, reliable infrastructure, accessible design, ethical data management, and institutional support. Digital activities should be connected with physical or workplace practice when important aspects of competence cannot be adequately represented online.

The proposed model provides a practical reference for vocational colleges and other institutions seeking to improve continuing education. Future empirical research should examine its implementation through actual learner evidence, comparative studies, and longitudinal workplace outcomes.

**Funding:** This research was supported by the Chongqing Vocational Education Teaching Reform Project, Innovation and Practice of Continuing Education Teaching Model Based on OBE Educational Concept and Integration of Virtual Simulation Technology (Grant No. Z233247X).

**Acknowledgments:** The author gratefully acknowledges the support of Chongqing College of Architecture and Technology and the teachers and educational technology professionals involved in continuing education reform.

## References

1. W. Jia, L. Zhang, and Z. Wang, "Application of virtual simulation technology to OBE-oriented continuing education," in *Proc. 8th Int. Conf. Image, Video Process., Artif. Intell. (IVPAI 2026)*, vol. 14276, SPIE, Sep. 2026, pp. 357–365.
2. R. Sapawi, A. Anuar, R. Wahi, N. T. Razali, and M. H. Hashim, "Alternative and online assessment in the context of outcome based education: A practical guide," *Turkish J. Comput. Math. Educ.*, vol. 12, no. 3, pp. 2376–2385, 2021.
3. E. C. D. L. A. Armas, "Virtual outcomes-based education (OBE) fair in a selected local university: A mixed method study," *Int. J. Caring Sci.*, vol. 18, no. 1, pp. 389–399, 2025.
4. Y. Han, J. Yang, Y. Diao, R. Jin, B. Guo, and Z. Adamu, "Process and outcome-based evaluation between virtual reality-driven and traditional construction safety training," *Adv. Eng. Informat.*, vol. 52, Art. no. 101634, 2022.
5. X. Wang and F. Xia, "Outcomes-based teaching reform of introduction of ships based on virtual simulation technology," *High. Educ.*, vol. 1, no. 4, pp. 104–108, 2024.

**Disclaimer/Publisher's Note:** The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of Publisher and/or the editor(s). Publisher and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.