INTERNATIONAL JOURNAL OF TEACHER EDUCATION RESEARCH STUDIES (IJTERS)
(Open Access, Double-Blind Peer Reviewed Journal)
ISSN Online: 3049-1614 ISSN Print:

Beyond Time-Based Metrics: Authentic Assessment in Competency-Driven Learning Environments

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Article information
Received: 12th June 2025
Received in revised form: 14th July 2025
Accepted: 16th August 2025
Available online: 18th September 2025

Volume: 2
Issue: 3
DOI: https://doi.org/10.5281/zenodo.17263933

Abstract

Traditional educational assessment models rely heavily on time-based metrics such as seat time, credit hours, and semester completion rates, which often fail to accurately measure student learning and competency acquisition. This paper examines the transition toward authentic assessment frameworks in competency-driven learning environments, analyzing how these approaches better align evaluation practices with actual learning outcomes. Through a comprehensive literature review and theoretical analysis, this study explores the characteristics, implementation strategies, and challenges of authentic assessment in educational technology integration contexts. The findings suggest that competency-based authentic assessment offers more meaningful evaluation of student learning by focusing on demonstrated mastery rather than time spent in instruction. However, successful implementation requires significant technological infrastructure, faculty development, and institutional culture change. The implications for educational practice include the need for redesigned assessment systems that prioritize learning evidence over temporal constraints, ultimately leading to more personalized and effective educational experiences.

Keywords: Authentic Assessment, Competency-Based Education, Educational Technology, Learning Analytics, Performance Assessment

I. INTRODUCTION

The landscape of educational assessment stands at a critical juncture as institutions worldwide grapple with the limitations of traditional time-based evaluation systems. For over a century, educational progress has been measured primarily through temporal metrics—credit hours completed, semesters attended, and seat time accumulated—rather than through demonstration of actual learning and competency acquisition (Johnstone & Soares, 2014). This paradigm, while administratively convenient, has increasingly proven inadequate for addressing the diverse learning needs of 21st-century students and the demands of a rapidly evolving knowledge economy.

The emergence of competency-driven learning environments presents a fundamental challenge to these established assessment practices. Unlike traditional models that assume learning occurs uniformly within prescribed timeframes, competency-based education (CBE) recognizes that students learn at different paces and through varied pathways (Gervais, 2016). This pedagogical shift necessitates corresponding changes in assessment methodology, moving from standardized, time-bound evaluations toward authentic assessment practices that capture the complexity and authenticity of real-world learning applications.

Authentic assessment, as conceptualized by educational researchers, refers to evaluation methods that require students to demonstrate their knowledge and skills in contexts that mirror real-world applications and professional practices (Mueller, 2018). This approach aligns naturally with competency-driven learning environments, where the focus shifts from coverage of curriculum content to mastery of specific, well-defined competencies. The integration of educational technology further enhances the potential for authentic assessment by enabling continuous monitoring of student progress, personalized feedback mechanisms, and sophisticated data analytics to inform instructional decisions.

The significance of this research lies in its potential to transform educational practice by providing a theoretical framework for implementing authentic assessment in technology-enhanced, competency-driven learning environments. As educational institutions increasingly adopt competency-based models and invest in educational technology infrastructure, understanding how to effectively assess student learning in these contexts becomes crucial for ensuring educational quality and student success.

This paper addresses the following research questions: How can authentic assessment frameworks replace traditional time-based metrics to better evaluate student learning in competency-driven educational environments? What are the key characteristics and implementation strategies for effective authentic assessment in technology-enhanced learning contexts? What challenges and opportunities emerge when transitioning from time-based to competency-based authentic assessment systems?

II. THEORETICAL FRAMEWORK

2.1. Constructivist Learning Theory and Assessment

The theoretical foundation for authentic assessment in competency-driven learning environments draws heavily from constructivist learning theory, which posits that learners actively construct knowledge through interaction with their environment and prior experiences (Vygotsky, 1978). This perspective challenges traditional assessment approaches that treat knowledge as static information to be transmitted and recalled, instead emphasizing the dynamic, contextual nature of learning.

Within this framework, assessment becomes a tool for understanding how students construct meaning and apply their knowledge in authentic contexts (Wiggins, 1993) argued that authentic assessment must reflect the complexity and ambiguity of real-world tasks, requiring students to engage in higher-order thinking skills such as analysis, synthesis, and evaluation. This approach aligns with the constructivist emphasis on learning as an active, meaning-making process rather than passive information Absorption.

2.2. Competency-Based Education Framework

Competency-based education represents a paradigm shift from time-based to outcome-based learning models. (Klein-Collins, 2012) defines CBE as "a structure that creates flexibility, allows students to progress as they demonstrate mastery of academic content, regardless of time, place, or pace of learning." This definition highlights three critical components that distinguish CBE from traditional educational models: flexibility in learning pathways, mastery-based progression, and independence from temporal constraints.

The competency framework typically includes several key elements: clearly defined learning outcomes, observable and measurable performance indicators, multiple assessment opportunities, and personalized learning pathways (Johnstone & Soares, 2014). These elements create an educational environment where assessment becomes an integral part of the learning process rather than an external evaluation mechanism.

2.3. Technology-Enhanced Learning and Assessment

The integration of educational technology in competency-driven learning environments creates new possibilities for authentic assessment implementation. Learning analytics, artificial intelligence, and adaptive learning systems provide unprecedented opportunities to monitor student progress, personalize learning experiences, and deliver timely feedback (Siemens & Long, 2011).

Digital portfolios, simulation-based assessments, and virtual reality applications exemplify how technology can support authentic assessment practices by creating immersive, realistic contexts for demonstrating competency (Reeves & Okey, 1996). These technological tools enable continuous assessment that captures learning as it occurs, moving beyond the snapshot approach of traditional testing toward more comprehensive and nuanced evaluation methods.

III. LITERATURE REVIEW

3.1. Evolution of Assessment Practices

Evolution of Assessment PracticesResearch by (Newmann & Archbald, 1992) highlighted the limitations of conventional assessment approaches, arguing that standardized tests often emphasize lower-order thinking skills and fail to capture students' ability to apply knowledge in meaningful contexts. Their work contributed to the growing recognition that assessment practices must align more closely with intended learning outcomes and real-world applications..

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3.2. Authentic Assessment Research

The concept of authentic assessment gained prominence in the 1990s through the work of educators and researchers who questioned the validity of traditional testing methods (Wiggins, 1993; Hart, 1994). Authentic assessment was characterized by several key features: realistic contexts, complex tasks requiring higher-order thinking, multiple acceptable solutions, and integration of knowledge across disciplines.

Empirical research has demonstrated the effectiveness of authentic assessment in promoting deeper learning and student engagement. A study by (Maclellan, 2004) found that students who experienced authentic assessment showed greater retention

of knowledge and improved ability to transfer learning to new contexts compared to those assessed through traditional methods. Similarly, research by (Ashford-Rowe et al., 2014) indicated that authentic assessment practices led to increased student motivation and more meaningful learning experiences.

3.3. Competency-Based Education Research

The implementation of competency-based education has been studied extensively in various educational contexts, from K-12 schools to higher education institutions. Research by (Sturgis et al., 2011) identified several key factors that contribute to successful CBE implementation: clear competency definitions, flexible pacing, multiple assessment opportunities, and strong technological infrastructure.

A comprehensive study by (Nodine, 2016) examined CBE programs across multiple institutions and found that successful programs shared common characteristics: well-defined competencies aligned with industry standards, robust assessment systems capable of measuring complex skills, and strong support systems for both students and faculty. The research also highlighted significant challenges, including the need for extensive faculty development and the complexity of designing valid and reliable competency assessments.

3.4. Technology Integration in Assessment

The integration of technology in educational assessment has evolved rapidly, driven by advances in learning analytics, artificial intelligence, and adaptive learning systems. Research by (Pellegrino & Quellmalz, 2010) explored how technology could enhance assessment practices by providing more frequent, detailed, and actionable feedback to both students and instructors.

Studies on digital portfolios have shown promise for supporting authentic assessment in competency-based environments. Research by (Barrett, 2007) demonstrated that electronic portfolios could effectively capture evidence of student learning across multiple competencies while providing opportunities for reflection and self-assessment. Similarly, work by (Cambridge, 2010) highlighted how digital portfolios support the documentation and evaluation of complex, authentic learning experiences.

Table 1. Comparison of Traditional vs. Authentic Assessment Characteristics

Characteristic	Traditional Assessment	Authentic Assessment
Context	Artificial/Classroom	Real-world/Applied
Task Structure	Standardized/Uniform	Varied/Complex
Timing	Fixed/Time-bound	Flexible/Ongoing
Evaluation Focus	Content Recall	Performance/Application
Feedback	Summative/Final	Formative/Continuous
Student Role	Passive/Recipient	Active/Constructor
Learning Evidence	Test Scores	Portfolio/Demonstrations

IV. ANALYSIS AND ARGUMENTS

4.1. The Limitations of Time-Based Assessment Metrics

Traditional educational assessment systems rely heavily on time-based metrics that fundamentally misalign with how learning actually occurs. The Carnegie Unit, which measures educational progress through seat time rather than learning achievement, exemplifies this disconnect (Silva et al., 2015). Research consistently demonstrates that students learn at different rates and through varied pathways, making time-based metrics inadequate measures of educational progress or competency acquisition.

The persistence of time-based assessment creates several problematic outcomes. First, it promotes a "one-size-fits-all" approach that fails to accommodate diverse learning styles and paces. Students who master content quickly are held back by artificial time constraints, while those requiring additional time are forced to progress before achieving mastery. Second, time-based systems incentivize compliance and attendance rather than learning and competency development, potentially undermining the fundamental purpose of education.

Furthermore, time-based metrics provide limited actionable information for improving instruction or supporting student learning. Knowing that a student completed 15 credit hours offers little insight into their actual capabilities, knowledge, or readiness for advanced study or professional practice. This limitation becomes particularly problematic in rapidly evolving fields where the relevance of knowledge and skills changes quickly, making the currency of learning more important than the time invested in acquiring it.

4.2. Authentic Assessment as a Solution Framework

Authentic assessment provides a compelling alternative to time-based metrics by focusing on demonstrated competency rather than temporal investment. This approach aligns assessment practices with real-world applications, creating more meaningful and relevant evaluation experiences for students (Herrington & Herrington, 2006). By requiring students to demonstrate their knowledge and skills in contexts that mirror professional practice, authentic assessment bridges the gap between academic learning and practical application.

The implementation of authentic assessment in competency-driven learning environments offers several advantages. First, it provides more valid measures of student learning by evaluating performance in realistic contexts rather than artificial

testing situations. Second, it supports the development of higher-order thinking skills by requiring students to analyze, synthesize, and evaluate information rather than simply recall facts. Third, it promotes deeper learning by encouraging students to make connections between different concepts and apply their knowledge to solve complex problems.

Research evidence supports the effectiveness of authentic assessment in promoting student learning and engagement. Studies have shown that students who experience authentic assessment demonstrate better retention of knowledge, improved problem-solving skills, and greater motivation to learn (Ashford-Rowe et al., 2014). These outcomes suggest that authentic assessment not only provides better measures of student competency but also enhances the learning process itself.

4.3. Technology's Role in Enabling Authentic Assessment

Educational technology plays a crucial role in making authentic assessment feasible and scalable in competency-driven learning environments. Digital tools and platforms enable the creation of realistic, immersive assessment experiences that would be difficult or impossible to implement using traditional methods (Mislevy et al., 2012). Virtual reality simulations, for example, can provide safe environments for students to practice and demonstrate complex skills without the risks associated with real-world applications.

Learning analytics and artificial intelligence further enhance authentic assessment by providing continuous monitoring of student progress and personalized feedback. These technologies can track multiple indicators of learning, identify patterns in student performance, and adapt assessment experiences to individual needs and preferences (Siemens & Long, 2011). This capability enables more nuanced and comprehensive evaluation of student competency than traditional assessment methods.

The integration of technology also supports the scalability of authentic assessment by automating certain evaluation processes and providing tools for efficient management of complex assessment data. Digital portfolios, for instance, allow students to compile evidence of their learning across multiple contexts and timeframes while providing instructors with organized, searchable repositories of student work (Barrett, 2007). This technological support makes it feasible to implement authentic assessment practices even in large-scale educational settings.

4.4. Implementation Challenges and Strategies

Despite its theoretical advantages, implementing authentic assessment in competency-driven learning environments presents significant practical challenges. One primary obstacle is the complexity of designing valid and reliable assessment instruments that accurately measure complex competencies while maintaining fairness across diverse student populations (Baartman et al., 2007). Unlike traditional tests with established psychometric properties, authentic assessments often require customized evaluation criteria and rubrics that must be carefully validated.

Faculty development represents another critical challenge, as many educators lack the training and experience necessary to design and implement effective authentic assessment practices. The shift from traditional grading methods to competency-based evaluation requires significant changes in pedagogical approach and assessment philosophy (Guskey, 2015). Successful implementation requires comprehensive professional development programs that address both the theoretical foundations and practical applications of authentic assessment.

Institutional culture and administrative systems also present barriers to authentic assessment implementation. Traditional academic structures, including registrar systems, financial aid policies, and accreditation requirements, are often built around time-based metrics and may not readily accommodate competency-based approaches (Johnstone & Soares, 2014). Overcoming these systemic barriers requires coordinated efforts at multiple organizational levels and sustained commitment to change.

V. CRITICAL EVALUATION

5.1. Strengths of Authentic Assessment Approaches

The literature provides compelling evidence for the effectiveness of authentic assessment in competency-driven learning environments. Research consistently demonstrates that authentic assessment practices lead to improved learning outcomes, increased student engagement, and better preparation for professional practice (Maclellan, 2004; Ashford-Rowe et al., 2014). These outcomes suggest that authentic assessment addresses fundamental limitations of traditional assessment methods by providing more meaningful and relevant evaluation experiences.

The alignment between authentic assessment and constructivist learning theory provides a strong theoretical foundation for its implementation. By recognizing learning as an active, contextual process, authentic assessment supports pedagogical approaches that emphasize student agency, real-world application, and deep understanding rather than surface-level memorization (Wiggins, 1993). This theoretical coherence strengthens the case for adopting authentic assessment practices in educational settings.

The technological capabilities now available further enhance the potential for authentic assessment implementation. Digital tools enable the creation of sophisticated, realistic assessment experiences that can adapt to individual student needs while providing rich data for evaluating learning progress (Mislevy et al., 2012). These technological affordances make authentic assessment more feasible and scalable than previous generations of educational technology allowed.

5.2. Limitations and Concerns

Despite its advantages, authentic assessment faces several significant limitations that must be acknowledged and addressed. The complexity of designing valid and reliable authentic assessments presents ongoing challenges for educators and institutions (Baartman et al., 2007). Unlike standardized tests with established psychometric properties, authentic assessments often require customized evaluation criteria that may lack the reliability and comparability of traditional measures.

The resource requirements for implementing authentic assessment can be substantial, particularly in terms of faculty time, technological infrastructure, and administrative support. Creating realistic assessment experiences often requires significant investment in technology, materials, and training that may not be feasible for all educational institutions (Reeves & Okey, 1996). These resource constraints may limit the scalability and accessibility of authentic assessment approaches.

Concerns about fairness and equity also merit consideration. Authentic assessments may inadvertently favor students with certain backgrounds, experiences, or resources while disadvantaging others (Darling-Hammond & Snyder, 2000). Ensuring that authentic assessments provide equitable opportunities for all students to demonstrate their competencies requires careful attention to assessment design and implementation practices.

5.3. Future Research Directions

The field would benefit from longitudinal studies examining the long-term effects of authentic assessment on student learning outcomes and career preparation. While existing research demonstrates short-term benefits, understanding the sustained impact of authentic assessment practices on student success and professional performance would strengthen the case for widespread adoption.

Research is also needed to develop more sophisticated approaches to ensuring the reliability and validity of authentic assessments. This includes developing new psychometric methods appropriate for complex, performance-based evaluations and establishing standards for comparing authentic assessment results across different contexts and institutions.

The integration of emerging technologies, including artificial intelligence and machine learning, presents opportunities for enhancing authentic assessment practices. Research exploring how these technologies can support more sophisticated evaluation of student performance while maintaining the authenticity and meaningfulness of assessment experiences would advance the field significantly.

VI. IMPLICATIONS

6.1. Theoretical Implications

This analysis contributes to the growing body of literature supporting the transition from time-based to competency-based educational models. The research reinforces the importance of aligning assessment practices with learning theories and pedagogical approaches, demonstrating that authentic assessment provides a more theoretically coherent approach to evaluation in competency-driven learning environments.

The findings also highlight the need for expanded theoretical frameworks that account for the role of technology in mediating authentic assessment experiences. As digital tools become increasingly sophisticated and prevalent in educational settings, understanding how technology shapes both the design and implementation of authentic assessment becomes crucial for theoretical development in the field.

6.2. Practical Implications

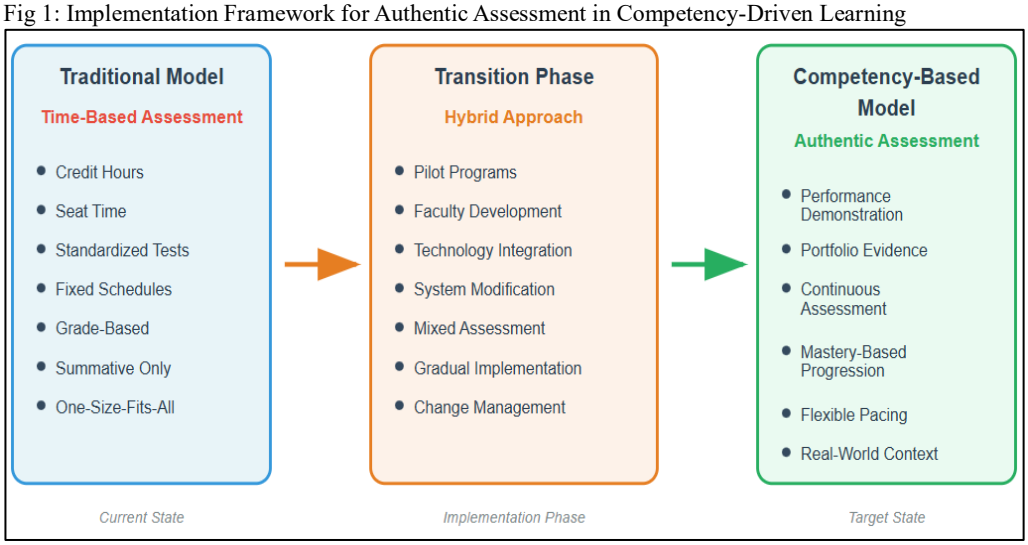
For educational practitioners, this research suggests several key considerations for implementing authentic assessment in competency-driven learning environments. First, successful implementation requires significant investment in faculty development to ensure educators have the knowledge and skills necessary to design and implement effective authentic assessment practices.

Second, institutions must be prepared to modify existing administrative and technological systems to support competency-based evaluation approaches. This may require substantial changes to student information systems, grading practices, and reporting mechanisms that have traditionally been organized around time-based metrics.

Third, the development of authentic assessment instruments requires careful attention to validity, reliability, and fairness considerations. Institutions should invest in expertise and resources to ensure that authentic assessments accurately measure intended competencies while providing equitable opportunities for all students.

Figure 1 illustrates the three-phase transition from traditional time-based assessment systems to competency-based authentic assessment models. The traditional model (left) relies on credit hours, seat time, and standardized testing approaches that emphasize temporal metrics over learning outcomes. The transition phase (center) represents a hybrid implementation period involving pilot programs, faculty development, technology integration, and system modifications necessary for successful transformation. The target competency-based model (right) features performance demonstrations, portfolio evidence, continuous assessment, and mastery-based progression that align with authentic assessment principles. This progressive framework provides educational institutions with a roadmap for implementing authentic assessment practices while managing the complexity of systemic change.

Fig 1: Implementation Framework for Authentic Assessment in Competency-Driven Learning



6.3. Policy Implications

The research findings have significant implications for educational policy at institutional, state, and federal levels. Accreditation bodies and regulatory agencies may need to revise standards and requirements that currently emphasize time-based metrics in favor of approaches that recognize competency-based achievement.

Financial aid policies, which typically rely on credit hour completion and satisfactory academic progress measures, may require modification to accommodate competency-based learning models. This could involve developing new metrics for determining student eligibility and progress that focus on learning achievement rather than temporal investment.

Quality assurance mechanisms in higher education may also need revision to effectively evaluate the effectiveness of competency-based programs. This includes developing new approaches to institutional assessment and program evaluation that account for the unique characteristics of authentic assessment practices.

VII. CONCLUSION

The transition from time-based metrics to authentic assessment in competency-driven learning environments represents a fundamental shift in educational philosophy and practice. This paper has demonstrated that traditional assessment approaches, rooted in temporal measures such as credit hours and seat time, fail to adequately capture the complexity and authenticity of student learning. In contrast, authentic assessment frameworks provide more meaningful and valid measures of student competency by emphasizing performance demonstration in realistic contexts.

The theoretical analysis reveals that authentic assessment aligns naturally with constructivist learning theory and competency-based education principles, creating coherent educational experiences that support deeper learning and meaningful skill development. The integration of educational technology further enhances the potential for authentic assessment by enabling sophisticated evaluation approaches that would be difficult to implement using traditional methods.

However, the implementation of authentic assessment in competency-driven learning environments is not without challenges. The complexity of designing valid and reliable assessment instruments, the need for extensive faculty development, and the requirement for significant technological and administrative infrastructure represent substantial barriers that must be addressed for successful adoption.

Despite these challenges, the evidence suggests that the benefits of authentic assessment—including improved learning outcomes, increased student engagement, and better preparation for professional practice—justify the investment required for implementation. As educational institutions continue to evolve in response to changing student needs and societal demands, the adoption of authentic assessment practices in competency-driven learning environments offers a promising pathway for improving educational quality and relevance.

The implications of this research extend beyond individual institutions to encompass broader educational policy and practice. The shift toward authentic assessment requires coordinated efforts at multiple levels, including changes to accreditation standards, financial aid policies, and quality assurance mechanisms. Successfully navigating this transition will require sustained commitment from educators, administrators, policymakers, and technology developers working collaboratively toward the common goal of improving educational effectiveness.

Future research should focus on developing more sophisticated approaches to ensuring the reliability and validity of authentic assessments while exploring the potential of emerging technologies to enhance evaluation practices. Longitudinal studies examining the long-term effects of authentic assessment on student outcomes would further strengthen the evidence base for these approaches.

Ultimately, the movement beyond time-based metrics toward authentic assessment in competency-driven learning environments represents a return to the fundamental purpose of education: fostering meaningful learning that prepares students for success in their personal and professional lives. By aligning assessment practices with this purpose, educational institutions can create more effective, engaging, and relevant learning experiences that better serve the needs of 21st-century learners.

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