

A Systematic Review of Learning Management Systems for Educational Continuity and Equitable Access

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ABSTRACT

Learning management systems became central to educational continuity during major disruptions, yet system availability did not ensure meaningful participation or learning. This structured integrative review synthesizes 289 publications across online learning, educational technology, teacher readiness, assessment, institutional resilience, and equity. Six dimensions organize the evidence: access and connectivity, learner engagement, teacher readiness, assessment integrity, institutional support, and equity and inclusion. The synthesis shows that continuity depends on a chain of conditions. Learners need reliable access and usable content; teachers need pedagogical and technical support; assessment requires credible design and proportionate safeguards; institutions need help systems, governance, and contingency planning. Weakness at any point shifts costs to students and widens existing inequalities. The paper contributes a continuity-capability framework, measurable indicators, and propositions for evaluating resilience beyond login counts or content delivery. The framework supports blended planning, targeted support, and empirical testing across education systems.

Keywords: learning management system; online learning; e-learning; digital divide; educational continuity; higher education

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INTRODUCTION

Learning management systems became central to educational continuity when institutions had to sustain teaching during widespread disruption. Yet access to an online system did not guarantee participation, instructional quality, credible assessment, or equitable outcomes. Research conducted during the COVID-19 period documented persistent digital divides involving connectivity, devices, affordability, digital skills, and household conditions [1-4]. Earlier work had already shown that online-learning systems in developing contexts face structural and organizational barriers [5,6]. Educational continuity must therefore be understood as a chain of capabilities rather than the simple availability of technology.

Learners require reliable access, usable content, timely communication, and support when technical or academic problems arise. Instructors require course-

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design competence, assessment strategies, manageable workloads, and responsive technical services. Studies of technology acceptance, e-learning adoption, and online learning management systems identify perceived usefulness, ease of use, institutional support, and local operating conditions as important influences on adoption and continued participation [7-10]. When

any link is weak, institutions may preserve scheduled teaching while losing interaction, feedback, or learning quality.

Continuity also depends on assessment integrity and inclusion. Emergency practices often transferred classroom materials and examinations online without adequate redesign. This created challenges involving authentication, academic honesty, accessibility, feedback, and unequal study environments. Research on implementation challenges and the development of e-learning systems shows that software functionality must be coordinated with pedagogy, policy, and support [11-14]. The digital-divide literature further warns that online delivery may reproduce or intensify cultural and socioeconomic exclusion when participation requirements exceed learners' resources [15].

Existing research frequently isolates connectivity, pedagogy, teacher readiness, assessment, and institutional resilience. Such separation obscures causal relationships. Poor access reduces participation; weak participation limits feedback; limited feedback affects achievement; and inadequate support increases withdrawal. Conversely, accessible content, trained instructors, credible assessment, responsive help, and contingency planning reinforce one another. A useful framework must therefore distinguish basic access from meaningful engagement and trace how institutional choices distribute benefits, risks, and additional burdens across learner groups [1,4,8,15].

This structured integrative review asks which capabilities sustain learning during disruption, how technology and pedagogy interact, and which indicators distinguish system activity from meaningful educational participation. It synthesizes 289 publications across six dimensions: access and connectivity, learner engagement, teacher readiness, assessment integrity, institutional support, and equity and inclusion. The paper contributes a continuity-capability framework, measurable indicators, and propositions for evaluating resilience beyond login counts or content delivery. The resulting model supports blended planning, targeted intervention, and empirical comparison while keeping educational quality and distributional effects central to continuity assessment [3,7,10,11].

Educational Continuity and LMS Evidence

Access and Connectivity

Access and connectivity determine whether an LMS supports continuity or reproduces interruption in digital form. Synchronous tools offer immediate

interaction but require stable bandwidth, compatible devices, and scheduled availability. Asynchronous materials reduce timing and connectivity demands, although poorly structured repositories shift the burden of navigation and self-regulation to learners. Institutions should assess device access, data cost, network reliability, electricity, disability access, and available study time before selecting a delivery mix. Participation rates need disaggregation because a high institutional average may conceal systematic exclusion. Continuity planning should prioritize essential learning activities, downloadable materials, low-bandwidth communication, and alternate submission routes. The relevant outcome is sustained access to instruction and feedback, rather than the number of accounts created or files uploaded [1-4].

2.2 Learner Engagement

Learner engagement is visible through patterns of participation, but activity logs require cautious interpretation. Frequent logins may reflect confusion, while a learner who downloads materials once may study effectively offline. Discussion contributions, assessment attempts, resource use, and help-seeking provide different signals and should be linked to course design. Self-regulation becomes especially important when schedules are disrupted, yet reminders alone do not resolve weak planning, anxiety, or competing responsibilities. Courses should provide clear weekly expectations, progress cues, manageable sequences, and timely human contact. Evaluation should combine trace data with learner accounts and achievement evidence. Engagement measures become useful when they trigger proportionate support and are not treated as direct measures of motivation or learning [5-8].

Teacher Readiness

Teacher readiness combines pedagogical design, technical fluency, workload capacity, and confidence in providing support at a distance. Emergency adoption often trains instructors to operate software without helping them redesign explanations, interaction, assessment, or feedback. Effective professional development uses the institution's actual tools and courses, includes practice with common failures, and provides continuing instructional support. Readiness should be measured through demonstrated tasks, course quality, response time, and the ability to adapt materials for low-bandwidth and accessible use. Institutions also need realistic workload policies because online continuity generates communication,

monitoring, and redesign demands. A system cannot compensate for insufficient preparation, unclear teaching responsibilities, or the absence of rapid assistance when instructors encounter a problem [9-12].

Assessment Integrity

Assessment continuity requires evidence of learning without imposing controls that exclude or misclassify students. Timed examinations and remote proctoring may preserve familiar procedures, but connectivity failures, privacy concerns, shared spaces, and device limits threaten validity. Alternatives include staged assignments, oral checks, projects, question banks, and open-resource tasks aligned with higher-order outcomes. Academic integrity should be addressed through design, communication, identity assurance proportionate to risk, and fair review of anomalies. Evaluation should track submission failure, accommodation, grading consistency, appeals, and evidence of learning. The central question is whether an assessment supports a defensible judgment under disrupted conditions, not whether it reproduces the physical examination room [13-16].

Institutional Support

Institutional resilience depends on integration among the LMS, student records, identity services, communication channels, libraries, and support operations. Fragmented systems force staff to reconcile rosters and results manually, increasing delay and error during disruption. Continuity plans should define data ownership, minimum service levels, backup communication, restoration priorities, vendor responsibilities, and decision authority. Routine exercises are needed because an untested backup or escalation plan offers limited assurance. Measures should include recovery time, unresolved incidents, synchronization errors, support demand, and the duration of learning interruption. Resilience is demonstrated when essential teaching and records processes continue or recover predictably, including during staff absence or vendor failure [17-20].

Equity and Inclusion

Equity and quality should be assessed together. Flexible access may widen participation while reducing interaction or feedback if courses rely on static files. Rich media may support understanding for some learners while excluding those with limited data or assistive-technology barriers. Institutions should examine access, engagement, achievement, satisfaction, and withdrawal

across relevant groups, then investigate the mechanisms behind differences. Support options should include accessible materials, device or connectivity assistance, academic guidance, and alternate communication routes. Quality assurance should review course design and learner outcomes, not software availability alone. An LMS supports educational continuity when learners retain a fair opportunity to participate, demonstrate learning, receive feedback, and progress during disruption [21-23].

Limits of LMS Continuity Research

The strongest evidence on learning management systems and educational continuity identifies interacting mechanisms rather than a single dominant tool. Results depend on the fit among the decision problem, data quality, implementation capacity, user behavior, and the consequence of error. Studies that isolate one performance indicator therefore provide only partial support for practice.

LMS studies report different results because access, participation, teaching practice, assessment, and learning outcomes are measured at different levels. Login frequency does not establish engagement, and platform availability does not establish continuity. The synthesis therefore follows the chain from access to instructional participation and educational outcome.

The literature often measures access to an LMS or user intention without demonstrating sustained participation, instructional quality, credible assessment, or learning recovery. It also underreports students who disappear from digital records because of access barriers.

The review retains six dimensions because each represents a separate point of failure: access and connectivity, learner engagement, teacher readiness, assessment integrity, institutional support, and equity and inclusion. Negative and inconsistent findings define moderators and limits rather than being discarded. This approach supports propositions that later studies may confirm, refine, or reject.

Continuity Synthesis and Implementation Gaps

Evidence relevant to learning management systems and educational continuity spans several research traditions, but those traditions do not provide equal forms of support. Direct domain studies establish the focal problem. Measurement and methodological studies clarify how constructs should be assessed. Governance and implementation studies identify controls and operating conditions. Cross-domain evidence is used



only to explain mechanisms or test transferability, not as direct proof of outcomes in the focal setting.

Evidence of continuity requires a pre-disruption baseline, a defined learner population, and measures of participation, completion, assessment, and support. Evaluation should identify students excluded by connectivity, device access, disability, language, or competing responsibilities. Institutional claims also need evidence beyond a single course or emergency semester.

The synthesis therefore treats access and connectivity, learner engagement, teacher readiness, assessment integrity, institutional support, and equity and inclusion as linked requirements. The framework predicts weak results when one requirement advances while another remains underdeveloped. This configuration logic explains why technically competent interventions may fail after implementation and why favorable pilot results may not persist at scale.

An LMS is one component of continuity, not a substitute for teaching capacity, accessible content, learner support, assessment design, and alternative delivery routes. Effects therefore depend on the surrounding educational system.

Further studies should define the continuity disruption, delivery model, learner group, course type, and comparison period. Reporting should include non-participation, missed assessment, instructor workload, support demand, and subgroup outcomes. Longer follow-up would show which emergency practices develop into sustainable teaching arrangements.

SYSTEMATIC REVIEW PROCEDURES

Review questions and continuity outcomes

The study used a structured integrative review

because the research questions concern mechanisms, interactions, measurement, and implementation rather than a pooled treatment effect. The analytical corpus comprised 289 publications spanning conceptual, empirical, methodological, and institutional work relevant to education systems using planned online, blended, and emergency remote delivery during disruption. Eligibility required a clear connection to at least one research question, identifiable methods or conceptual reasoning, and enough detail to evaluate the claim advanced.

The search removed duplicates, platform marketing, incomplete reports, and sources without evidence relevant to educational continuity. Studies of access, engagement, teacher readiness, assessment, institutional support, and equity were retained. Differences were interpreted by educational level, course design, infrastructure, and disruption context.

Evidence coding and study appraisal

Extraction recorded the institution, learner population, course context, delivery model, access condition, teaching practice, assessment method, outcome, support resource, and limitation. Appraisal examined participation bias, outcome validity, transparency of the intervention, and attention to excluded learners.

Open coding identified recurring problems and mechanisms. Axial coding organized relationships among inputs, processes, controls, outputs, and outcomes. Integrative coding consolidated the evidence into six dimensions: access and connectivity, learner participation, teacher readiness, assessment integrity, institutional support, equity and inclusion. Negative cases and inconsistent findings were retained to identify moderators, failure modes, and limits to transfer. The propositions were formulated only after the construct

Table 1: Evidence integration map for learning management systems and educational continuity

<i>Evidence domain</i>	<i>References</i>	<i>Role in synthesis</i>
Access and connectivity	[1-48]	Defines the focal construct and its principal outcome.
Learner engagement	[49-96]	Clarifies mechanisms, competing explanations, and performance conditions.
Teacher readiness	[97-144]	Informs measurement validity, comparison criteria, and analytical design.
Assessment integrity	[145-192]	Tests contextual transfer, implementation capacity, and operational constraints.
Institutional support	[193-240]	Supports governance, assurance, accountability, privacy, and risk controls.
Equity and inclusion	[241-289]	Informs cross-domain interpretation, boundary conditions, and future validation.

Table 2: Comparative dimensions and evaluation rules

<i>Dimension</i>	<i>Operational definition</i>	<i>Primary indicators</i>	<i>Decision risk</i>
Access and connectivity	The observable capability represented by access and connectivity in the proposed model.	device access; connection reliability; content availability	Weak validity or unmeasured outcome
Learner participation	The observable capability represented by learner participation in the proposed model.	active participation; persistence; task completion	Inconsistent interpretation or control
Teacher readiness	The observable capability represented by teacher readiness in the proposed model.	design competence; response time; teaching presence	Misleading average or hidden failure
Assessment integrity	The observable capability represented by assessment integrity in the proposed model.	verification; feedback quality; assessment validity	Delay, overload, or unstable response
Institutional support	The observable capability represented by institutional support in the proposed model.	support resolution; continuity planning; service uptime	Misuse, exclusion, or weak accountability
Equity and inclusion	The observable capability represented by equity and inclusion in the proposed model.	participation gap; accessibility; differential outcomes	Learning failure or unsupported scaling

definitions, mechanisms, and measurable indicators had been specified.

Educational scope and review limits

The evidence spans different education levels, disruption types, delivery modes, and outcome definitions. The framework supports structured comparison but not a pooled causal estimate. The synthesis therefore reports mechanisms, trade-offs, and testable propositions rather than universal effects. Future validation should use preregistered measures, transparent sampling, subgroup analysis, sensitivity tests, and longitudinal outcome assessment where feasible.

Continuity Findings and Educational Interpretation

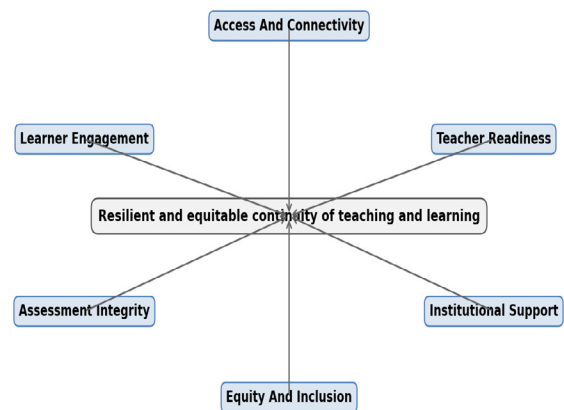
Continuity and equity framework

Educational continuity depends on access, learner engagement, teacher readiness, assessment integrity, institutional support, and equity. Connectivity alone does not sustain learning when teachers lack course-design support or students cannot participate consistently. Assessment controls also lose value when they impose burdens that exclude learners with limited devices or bandwidth. Table 2 therefore connects system performance to participation, instructional quality, and continuity outcomes [121-125].

Figure 1 shows how access, engagement, teacher readiness, assessment, institutional support, and equity jointly determine educational continuity. Evidence from participation and learning should guide course design, support services, assessment rules, and infrastructure investment. The framework treats continuity as an instructional and organizational outcome. [126-129]

Participation mechanisms and continuity breakdowns

Access is necessary but insufficient. Device availability and connectivity do not ensure participation when


Figure 1: Integrated analytical framework.


learners lack suitable study conditions, time, support, or accessible content. [130-134]

Participation is a distinct continuity outcome. Login activity can coexist with low cognitive engagement, weak task completion, and withdrawal. [135-139]

Teacher readiness combines technology use, instructional design, communication, assessment, and learner support. Tool familiarity alone does not establish online teaching capability. [140-144]

Assessment integrity requires alignment between learning objectives, task design, feedback, identity assurance, and feasible conditions. Surveillance-heavy controls can create inequitable burdens. [145-149]

Institutional continuity depends on coordinated academic, technical, administrative, and student-support functions. Isolated platform provision leaves failure points unresolved. [150-154,177]

Equity should be evaluated through differential participation and outcomes, not average access. Disability, location, income, language, and caregiving responsibilities shape continuity. [155-159]

Propositions for continuity outcomes

P1: Study-condition adequacy mediates the relationship between connectivity and sustained learner participation.

Validation of this proposition requires a defined unit of analysis and prespecified indicators. Researchers should report the proposed mechanism, competing explanations, subgroup results, and uncertainty. Core indicators include device access; connection reliability; content availability. [160-164]

P2: Teaching presence strengthens the effect of platform access on task completion.

An empirical test should state the comparison condition, measurement period, and indicators before

analysis. Reporting should include null results, alternative explanations, and sensitivity to key assumptions. Core indicators include active participation; persistence; task completion. [165-169]

P3: Instructional-design competence has a stronger effect on learning continuity than tool familiarity alone.

Researchers should test this relationship with transparent measures and a credible baseline. The analysis should distinguish the proposed pathway from confounding influences and report variation across relevant groups. Core indicators include design competence; response time; teaching presence. [170,171]

P4: Assessment flexibility improves validity when learner conditions vary substantially.

Assessment should link the proposition to observable process and outcome measures. A defensible test reports effect size, uncertainty, adverse results, and the conditions under which the relationship weakens. Core indicators include verification; feedback quality; assessment validity. [172-175]

P5: Cross-functional support coordination reduces the duration and recurrence of continuity failures.

Prospective evaluation is preferable because it fixes the prediction, intervention, and outcome windows in advance. Results should include implementation fidelity, competing mechanisms, and sensitivity checks. Core indicators include support resolution; continuity planning; service uptime. [153,176-179]

P6: Accessibility and targeted support reduce subgroup gaps in participation and completion.

Testing should combine quantitative outcomes with process evidence explaining how the proposed relationship operated. Replication across settings is needed before treating the proposition as general. Core indicators include participation gap; accessibility; differential outcomes. [160-164]

Table 3. Staged implementation and evaluation pathway

Stage	Required action	Decision output
1 Diagnose	Define decision, unit, baseline, users, and failure costs	Approved problem statement and baseline
2 Govern	Assign owners, definitions, access, review, and escalation	Accountable operating design
3 Prepare	Assess data quality, workflow fit, capacity, and safeguards	Readiness evidence and test plan
4 Pilot	Test normal cases, edge cases, subgroup effects, and failure recovery	Pilot results with uncertainty
5 Scale	Expand only when reliability, usability, equity, and workload thresholds are met	Controlled implementation
6 Learn	Monitor outcomes, drift, exceptions, complaints, and corrective action	Revised rules and sustained learning

LMS readiness and continuity planning

Continuity planning starts with course and learner needs rather than software features. Institutions establish minimum access, prepare instructors, redesign essential activities and assessment, test fallback channels, and monitor participation. Expansion follows evidence that students remain engaged and supported during disruption.

5 Conclusion for Educational Continuity

This structured integrative review developed a multidimensional continuity model that separates access, participation, instructional quality, assessment integrity, institutional response, and equity. Its central finding is that continuity of access, participation, teaching, assessment, and learning depends on the interaction of access and connectivity, learner participation, teacher readiness, assessment integrity, institutional support, equity and inclusion, rather than on one tool, metric, or control.

The synthesis explains continuity through the interaction of access, engagement, teacher readiness, assessment integrity, institutional support, and equity. Its measures distinguish technical availability from participation and learning, allowing institutions to test where continuity fails.

Institutions should identify essential learning activities, excluded student groups, instructor support needs, assessment risks, and fallback channels before adopting an LMS continuity plan. Exercises should test low-connectivity access, communication failure, assessment disruption, and recovery.

The evidence spans different education levels, disruption types, delivery modes, and outcome definitions. The framework supports structured comparison but not a pooled causal estimate. Future research should test the propositions prospectively, compare alternative specifications, report null and adverse outcomes, and examine whether benefits persist after initial implementation.

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