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State of the art approaches to the quality of distance education

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Abstract. This article examines contemporary approaches to quality assurance in distance education from a comprehensive perspective. To address this multifaceted topic, we analyze general frameworks for educational quality, European quality assurance standards, and specific frameworks for distance learning quality, with particular attention to the five pillars of quality established by the Online Learning Consortium. Through a systematic literature review, we identify emerging models and frameworks developed since 2020 in response to the global shift to distance education during the COVID-19 pandemic. The analysis reveals significant evolution in quality frameworks, moving beyond student satisfaction to incorporate multiple stakeholder perspectives, data-driven assessment methods, competency-based approaches, and institutional resilience factors. We also examine methodological approaches to quality assessment, post-pandemic shifts in quality frameworks, and practical implementation strategies for educational institutions. The findings demonstrate that quality assurance in distance education requires a multidimensional approach that balances technological infrastructure, pedagogical effectiveness, and stakeholder satisfaction while addressing contextual factors. We conclude that as distance education becomes increasingly embedded in mainstream educational practices, quality frameworks continue to evolve toward more comprehensive, flexible, and contextually responsive models that incorporate lessons learned during the pandemic era.

Keywords: quality frameworks, distance education, e-learning, quality assurance, educational assessment, COVID-19 pandemic, higher education

1. Introduction

Educational processes have been an integral part of human existence for millennia, evolving from teaching by shamans and tribal elders to the sophisticated, systematic approaches employed today [9]. The assessment of education quality emerged as a distinct field of inquiry following industrialization, with early models conceptualizing education as a product or service with an optimal price-quality ratio [48]. This perspective has since expanded, recognizing the multifaceted nature of education quality and acknowledging diverse stakeholder expectations – from parents and governments to students, teachers, employers, and institutions – each with different priorities and expectations [16, 24].

While the pursuit of educational quality has been ongoing for decades, the COVID-19 pandemic precipitated an unprecedented global experiment in distance education, forcing educational institutions worldwide to adopt remote learning modalities rapidly

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[55, 59, 67]. This transition brought renewed attention to questions of quality in distance education, highlighting both strengths and shortcomings in existing approaches and accelerating innovation in quality assessment frameworks. As noted by Nicol and Bice [39], this period of crisis required educational institutions to demonstrate remarkable resilience and adaptability, often redefining fundamental aspects of how quality is conceptualized and measured in remote learning environments.

The pandemic-driven transition has revealed that distance education quality encompasses far more than technological infrastructure or course design. Contemporary approaches increasingly recognize the importance of institutional readiness, faculty development, student support services, and complex pedagogical considerations specific to remote learning contexts [18, 29]. Moreover, as emergency remote teaching gives way to strategically designed distance education, institutions are seeking more sophisticated and comprehensive approaches to quality assurance that incorporate lessons learned during this forced experiment [2, 36].

This article examines the current state of approaches to quality assurance in distance education. It begins with a review of general conceptualizations of educational quality before exploring European quality frameworks and specific models for distance learning. We then analyze emerging frameworks developed since 2020, considering methodological approaches to quality assessment, post-pandemic shifts in quality frameworks, and practical strategies for implementation. By synthesizing these diverse perspectives, we aim to provide a comprehensive understanding of how quality in distance education is currently conceptualized, measured, and enhanced.

2. Methodology

2.1. Research approach and framework

This study employs a systematic literature review approach to examine contemporary approaches to quality in distance education comprehensively. Following the methodological recommendations of Pearce [44] and Bernard et al. [5], we developed a structured framework for identifying, analyzing, and synthesizing relevant literature. The review methodology was designed to ensure comprehensive coverage of both established and emerging frameworks for quality assurance in distance education, with particular attention to developments since 2020 in response to the COVID-19 pandemic.

Three primary research questions guided our methodological approach:

1. How has the conceptualization of quality in distance education evolved, particularly in response to the COVID-19 pandemic?
2. What frameworks and models are currently employed to assess and assure quality in distance education?
3. What practical implications do these frameworks offer for educational institutions seeking to enhance the quality of their distance education offerings?

2.2. Literature search and selection

We conducted a comprehensive search of academic databases Scopus, Web of Science, and ERIC. The search strategy employed the following key terms and their combinations: “distance education”, “online learning”, “e-learning”, “remote learning”, “quality”, “quality assurance”, “quality framework”, “quality assessment”, “COVID-19”, and “pandemic”. To ensure currency, we prioritized literature published between 2015 and 2024, with particular emphasis on works published since 2020 to capture pandemic-related developments.

The initial search yielded 1486 potentially relevant studies. After removing duplicates, 1269 studies remained for initial screening. Title and abstract screening,

followed by a full-text review based on our inclusion and exclusion criteria, resulted in a final corpus of 162 studies included in the review.

2.3. Inclusion and exclusion criteria

Studies were included if they met the following criteria:

- Focused on quality assurance, assessment, or enhancement in distance education contexts
- Published in peer-reviewed journals, conference proceedings, or as technical reports from recognized organizations
- Published in English or with reliable English translations available
- Provided empirical data, theoretical frameworks, or comprehensive reviews relevant to the research questions

Studies were excluded if they:

- Focused exclusively on technology implementation without addressing quality dimensions
- Addressed educational quality broadly without specific application to distance education contexts
- Consisted of opinion pieces without substantive theoretical or empirical foundations
- Were published before 2015 unless considered seminal works in the field

2.4. Data extraction and analysis

From each included study, we extracted information regarding:

- Conceptualization of quality in distance education
- Frameworks, models, or approaches for quality assessment or assurance
- Methodological approaches employed
- Key findings and implications
- Contexts and settings of the application
- Strengths and limitations identified

Data analysis followed a thematic synthesis approach, identifying common themes, frameworks, and evolving perspectives across the literature. We employed both deductive coding based on established quality dimensions and inductive coding to capture emerging themes and innovations. This approach allowed us to develop a comprehensive understanding of the current landscape of quality approaches in distance education while identifying trends and developments since the onset of the COVID-19 pandemic.

3. General approaches to the quality of education

Education serves as a fundamental tool for national development, with its quality determining its effectiveness and impact [24]. From a pedagogical perspective, educational quality encompasses the implementation and development of educational processes, teaching methodologies, educational technologies, faculty competence, learning environments, and student-teacher interactions [47].

Quality in education extends beyond mere compliance with minimal standards, representing the sum of features and properties that enable educational services to meet identified and anticipated needs [22]. UNESCO defines quality education as “a type of education that offers all young people and other learners competencies adapted to the specific context in which they live and allowing them to actively participate in

social life" [17, p. 399]. This definition highlights the contextual nature of quality and its ultimate purpose in enabling social participation.

Stakeholder perspectives significantly influence how educational quality is conceptualized. Grudowski and Lewandowski [17] define it as the degree to which education meets requirements formulated by students, employees, potential employers, and researchers. Hnatyshak [20] further characterizes educational quality within universities as fulfilling the expectations of both internal and external stakeholders across all aspects of the educational process. This stakeholder-centered approach aligns with contemporary quality models in higher education, which increasingly incorporate perspectives beyond traditional academic metrics [65].

The assessment of educational quality typically occurs at multiple levels, from national education systems to individual institutions. At the national level, the quality assessment may be based on indicators of sustainable development [51], while at the institutional level, competition among universities can drive quality improvement as institutions seek to attract students in competitive educational markets. Accreditation procedures represent one mechanism for ensuring quality, with official (state), public, and public-professional accreditations serving different purposes within quality assurance systems [51].

Contemporary approaches to educational quality can be categorized through various conceptual lenses, as summarized in table 1.

Table 1
Conceptual approaches to quality of education (adapted from Kumar and Sarangapani [26] and Jain and Prasad [24]).

Approach	Key characteristics
Humanistic approach	Views learning as a social practice; educational programs adapt to individual needs rather than following standardized formats; emphasizes self-assessment and peer evaluation; positions teacher as a facilitator rather than an instructor; prioritizes personal development and meaning-making.
Behavioral approach	Employs standardized and controlled curricula based on established learning objectives; assessment focuses on objective measurement of learned behavior against predetermined criteria; centralizes tests and examinations; positions teacher as expert controlling stimuli and responses; emphasizes measurable outcomes.
Critical approach	Promotes education that catalyzes social change; incorporates teaching methods that foster critical analysis; encourages active student participation in developing learning experiences; questions power structures and dominant narratives; emphasizes education as transformative practice.
Indigenous perspective	Emphasizes alignment between education and socio-cultural contexts; recognizes learners' prior knowledge from diverse experiences; positions learners as active participants in curriculum development; extends learning beyond formal classrooms through informal and lifelong learning; values cultural knowledge systems.
Adult education perspective	Centres experience and critical reflection as quality indicators; recognizes students as socially situated; builds on experiential knowledge as foundation for learning and social action; emphasizes self-direction and transformative learning; acknowledges diverse learning pathways.

Beyond these conceptual approaches, Cheong Cheng and Ming Tam [7] identified three strategic approaches to improving educational quality:

1. **Identification strategy** – focuses on identifying and addressing problems that impede quality improvement within educational institutions

2. **Organizational learning model** – conceptualizes quality as dynamic, emphasizing continuous development of all participants (faculty, administration, students) and assessment practices
3. **Comprehensive quality management** – involves all educational stakeholders in continuous improvement of internal processes while meeting external expectations (labour market demands, political, economic, and social considerations)

These approaches have been further developed in recent years with increased attention to technological integration and competency-based models. Zaid Abualkishik et al. [65] emphasize outcome-based assessment in quality assurance, while Ireland, Correia and Griffin [21] propose a three-part framework focusing on design quality, teaching quality, and learning quality in educational contexts. These developments reflect a growing recognition that quality assurance must address both process and outcome dimensions of education.

The evolution of these approaches suggests that quality assessment must adapt to changing educational contexts and student needs. As Ratner and Tikhonova [47] observe, introducing new educational forms requires developing optimal assessment methodologies to evaluate their effectiveness, impact on student outcomes, and stakeholder satisfaction. This adaptive approach to quality assessment becomes particularly critical in the context of distance education, where traditional quality metrics may require significant reconceptualization.

4. Approaches to education quality in Europe

European approaches to educational quality reflect the continent's diverse educational traditions while increasingly converging around shared frameworks and standards. While no universal system for assessing educational quality exists globally [24], European countries have developed relatively cohesive approaches, particularly within the European Higher Education Area (EHEA).

Many European nations regulate quality assessment through legislation and dedicated agencies. The United Kingdom, for instance, has established specialized institutions, including the Qualifications Curriculum Authority (QCA) in England, the Qualifications, Curriculum and Assessment Authority for Wales (ACCAC), the Council for the Curriculum Examinations and Assessment (CCEA) in Northern Ireland, and the Scottish Qualifications Authority (SQA). These institutions reflect the UK's devolved approach to educational governance while maintaining coordination on quality standards.

A significant development in European quality assurance has been the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG), updated in 2015. While not prescriptive, these guidelines provide a common framework for quality assurance across EHEA institutions. The ESG focuses on quality in learning and teaching, including learning environments and connections to research and innovation [13]. As outlined in table 2, the ESG addresses quality assurance at three levels: internal (within institutions), external (by quality assurance agencies), and the quality of the assurance agencies themselves.

Individual European countries have developed quality approaches that align with ESG while reflecting national priorities. Romania's educational system, for instance, defines quality assurance as "a group of actions aimed at developing the institutional capacity to elaborate, plan and implement education programs" that enable "recipients [to] become confident that quality standards are met by the education supplying institution" [49, p. 386]. This definition emphasizes institutional capacity building and stakeholder confidence in meeting established standards.

Table 2
ESG standards for quality assurance (adapted from European Association for Quality Assurance in Higher Education (ENQA) et al. [13]).

Level	Components
Internal quality assurance	• Policy for quality assurance • Design and approval of programs • Student-centered learning, teaching, and assessment • Student admission, progression, recognition, and certification • Teaching staff qualifications and development • Learning resources and student support • Information management systems • Public information transparency • Ongoing monitoring and periodic program review • Cyclical external quality assurance
External quality assurance	• Consideration of internal quality assurance • Design of methodologies fit for purpose • Implementation processes • Peer-review expert assessment • Criteria for outcomes • Reporting procedures • Complaints and appeals processes
Quality assurance agencies	• Activities, policy, and processes for quality assurance • Official status and recognition • Independence from institutions evaluated • Thematic analysis capabilities • Resource adequacy • Internal quality assurance procedures • Cyclical external review of agencies

In Poland, Croatia, and several other European countries, the SERVQUAL model has been adapted for educational quality assessment [27, 58]. This approach evaluates five dimensions of service quality:

1. **Reliability** – consistency between advertised and actual educational services
2. **Tangibility** – quality of physical facilities, equipment, and learning resources
3. **Responsiveness** – willingness and readiness of staff to assist students
4. **Assurance** – staff competence, knowledge, and ability to inspire trust
5. **Empathy** – individualized attention and responsiveness to student needs

Recent developments in European quality assurance include greater attention to the role of accreditation agencies as stakeholders in quality processes. Toprak and Sakar [54] highlight the importance of these agencies as advisors that help institutions select appropriate quality models and tools based on delivery modes and institutional

contexts. This advisory role has become particularly significant as institutions navigate the transition to distance and hybrid educational models.

The pandemic period has also prompted a reevaluation of quality approaches throughout Europe. Polinkevych, Khovrak and Trynchuk [45] document how Ukrainian institutions developed innovative mechanisms for managing educational quality in technical specialities during wartime conditions, with technological strategies playing a central role. Similarly, Gaftandzhieva, Doneva and Jagatheesaperumal [14] identify evolving approaches to quality assurance in distance learning across Europe, highlighting the importance of regulatory frameworks, assessment organizations, and stakeholder satisfaction in ensuring quality.

These developments reflect a broader trend toward more comprehensive, multi-level approaches to quality assurance across European higher education, with increasing attention to the specific challenges and opportunities presented by distance education modalities.

5. Quality of distance learning

Distance education quality has emerged as a critical focus area, particularly as information and communication technologies (ICT) have transformed educational delivery options. While early distance education involved correspondence through paper letters [19, 61], contemporary distance learning leverages diverse digital technologies to facilitate synchronous and asynchronous learning. Parallel developments in quality assurance have accompanied this technological evolution of approaches specific to distance education.

The COVID-19 pandemic accelerated the adoption of distance education worldwide and heightened attention to quality concerns. As Clark et al. [8] and Schneider and Council [50] observe, the pandemic effectively collapsed distinctions between distance learning and online learning in popular discourse, with both terms increasingly used interchangeably. This convergence has implications for how quality is conceptualized and assessed in remote learning environments.

5.1. Foundational frameworks for distance education quality

One of the most influential frameworks for distance education quality was developed by the Sloan Consortium (now the Online Learning Consortium). Their "Five Pillars" model, outlined by Lorenzo and Moore [32], has become a foundational framework in the field. Table 3 summarizes these dimensions and their key components.

This framework has been widely adopted but also critiqued for insufficient attention to specific dimensions. Esfijani [12] notes that many quality frameworks, including the Five Pillars, focus primarily on student perspectives while giving insufficient attention to other stakeholders such as administrators and instructional designers. Similarly, Masoumi and Lindström [34] observe that most frameworks emerge from Western contexts and inadequately address cultural dimensions that may significantly impact distance education quality.

5.2. Evolving quality frameworks

Since 2012, several significant frameworks have emerged that address the limitations of earlier models while responding to evolving educational contexts. These newer frameworks demonstrate increasing sophistication in how distance education quality is conceptualized and assessed.

5.2.1. PDPP evaluation model

The PDPP (Planning, Development, Process, Product) evaluation model proposed by Zhang and Cheng [66] offers a comprehensive framework for e-learning quality

Table 3
Five pillars of quality in distance education (adapted from Lorenzo and Moore [32] and Online Learning Consortium [40]).

Pillar	Description
Learning effectiveness	Ensures comparable or superior learning outcomes compared to traditional formats; leverages unique opportunities of online environments; employs appropriate pedagogical approaches for distance contexts; incorporates regular assessment of learning outcomes.
Student satisfaction	Focuses on student experiences with faculty interactions, technical support, peer engagement, and overall educational process; emphasizes the importance of satisfaction for sustaining student interest and engagement; incorporates regular feedback mechanisms.
Faculty satisfaction	Addresses faculty experience with technical and informational support; considers recognition and rewards for distance teaching; supports research related to online teaching; promotes faculty development opportunities; creates sustainable workload models.
Cost effectiveness	Balances educational quality with financial sustainability; optimizes development and maintenance costs for technical infrastructure; considers cost-benefit relationships for institutions and students; ensures appropriate resource allocation.
Access	Provides comprehensive support for student completion; includes academic support (materials, information resources), administrative support (including accommodations for students with disabilities), and technical support (help desk, resource access); removes barriers to participation.

assurance. This four-phase model addresses both preparatory and operational aspects of distance education:

1. **Planning evaluation** – assesses market demand, feasibility, target student demographics, course objectives, and financial planning
2. **Development evaluation** – examines instructional design, course materials, website design, flexibility, interaction capabilities, support systems, and assessment strategies
3. **Process evaluation** – monitors technical support, website utilization, learning interaction, evaluation processes, support systems, and program flexibility
4. **Product evaluation** – measures student satisfaction, teaching effectiveness, learning outcomes, and program sustainability

Zhang and Cheng [66] validated this model through a case study of a research methods course offered collaboratively by universities in Hong Kong and mainland China. Their findings indicated high student satisfaction across all dimensions, with particular emphasis on the value of cross-border collaborative learning, student-centred approaches, and flexible learning options.

5.2.2. Hierarchy-based analysis approach

More recently, Ye et al. [63] proposed a hierarchy-based analysis approach for evaluating blended learning quality. Their model focuses particularly on student engagement across three dimensions:

1. **Behavioral engagement** – observable participation in learning activities
2. **Emotional engagement** – affective responses to learning experiences

3. **Cognitive engagement** – investment in comprehending complex ideas and mastering skills

Using gradient boosting models and feature importance evaluation methods, Ye et al. [63] found that cognitive and emotional engagement were more significant predictors of learning quality than behavioural engagement alone. This finding suggests that quality assessment frameworks should prioritize deeper forms of engagement beyond surface-level participation metrics.

5.2.3. PADICA competency-based learning model

The PADICA model developed by Theerathammakorn, Soontornchai and Amornrit [53] specifically addresses distance education in post-pandemic contexts. This competency-based framework comprises eight elements and six procedural steps:

1. **Planning** – strategic preparation for learning experiences
2. **Analysis** – needs assessment and contextual examination
3. **Designing** – creation of learning experiences and materials
4. **Improvement** – ongoing refinement based on evidence
5. **Confirmation** – validation of approaches and outcomes
6. **Application** – implementation in authentic contexts

The model emphasizes the development of "four Cs" competencies: critical thinking, creativity, communication, and collaboration. Evaluation of the framework revealed significant improvements in critical thinking and creative skills among students, with particular effectiveness for weekly e-learning structured around industry needs. The PADICA model demonstrates how quality frameworks have evolved to incorporate competency development as a central quality metric in distance education.

5.2.4. Unified quality control model

Allehaibi and Albaqami [3] propose a unified framework for total quality management in e-learning systems. Their tri-dimensional model integrates:

1. Quality assurance policies formalized through policy-based approaches
2. E-learning platform specifications for teaching and learning activities
3. Quality control process loops for continuous improvement

This model emphasizes the importance of policy frameworks, technological specifications, and continuous monitoring in ensuring high-quality distance education. The authors argue that this approach allows for optimal delivery of learning services while maintaining flexibility to accommodate diverse institutional contexts.

Figure 1 represents an integrated model showing how different quality dimensions interact with quality assurance processes in a continuous cycle. The core represents overall distance education quality, surrounded by four key dimensions (institutional framework, pedagogical dimension, technological infrastructure, and stakeholder experience). The outer elements represent the cyclical processes involved in quality assurance.

5.3. Standards and regulatory frameworks

Complementing these conceptual frameworks, international standards organizations have developed formal guidelines for distance education quality. The International Organization for Standardization (ISO) has released several relevant standards:

1. ISO/IEC 40180:2017provides a quality reference framework for e-learning

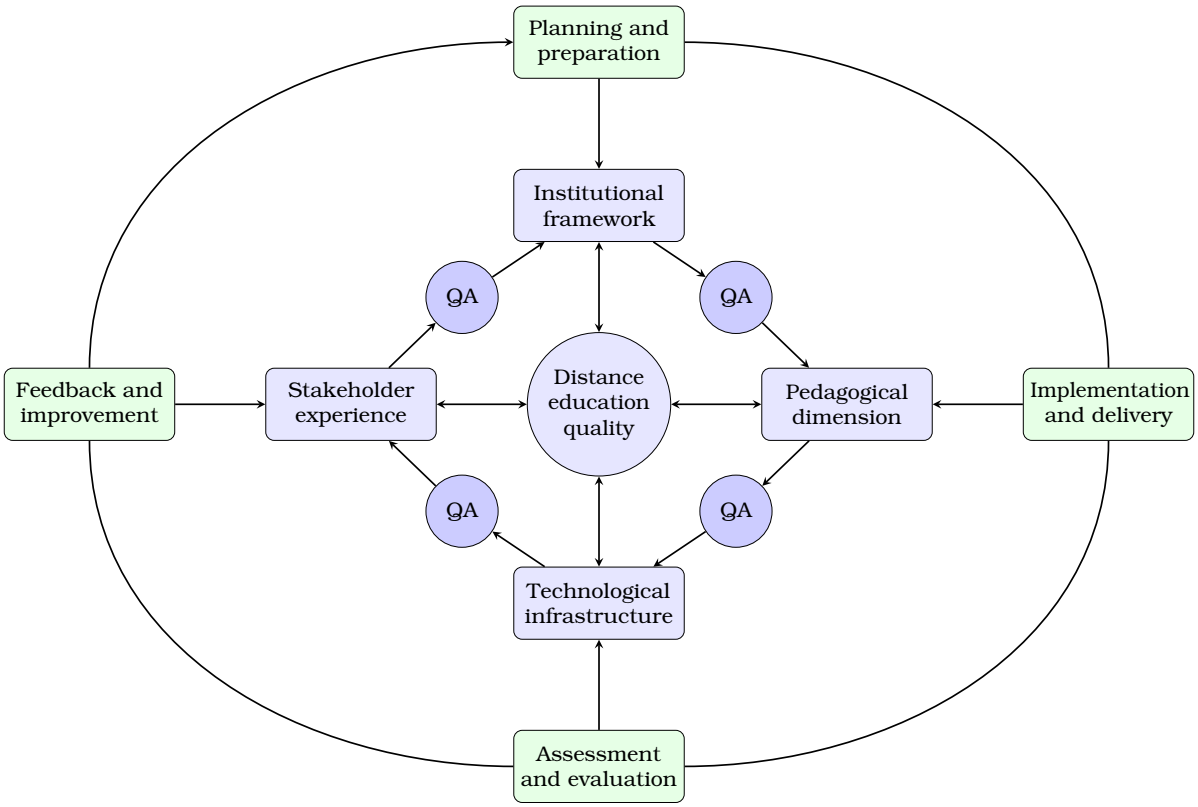

Figure 1: Integrated model of distance education quality dimensions and processes (adapted from Li [28]).

2. ISO 21001:2018 offers guidelines for managing processes in educational organizations
3. ISO 29994:2021 specifies requirements for distance learning services, including learning materials and evaluation processes

The ISO 29994 standard, released in 2021, is particularly significant as it addresses pressing issues in distance education, including specifications for learning materials and protocols for monitoring and evaluating distance learning services [23].

Together, these evolving frameworks and standards reflect the maturation of the distance education field and growing sophistication in conceptualizing and measuring quality in remote learning environments. They demonstrate movement beyond simplistic metrics toward multidimensional approaches that address diverse stakeholder needs, technological considerations, pedagogical effectiveness, and student outcomes.

6. Methodological approaches to quality assessment

The quality assessment of distance education requires robust methodological approaches to ensure reliability, validity, and practical utility. Recent research has explored diverse methodological frameworks, ranging from established techniques adapted to distance contexts to innovative approaches leveraging emerging technologies and analytical methods (figure 2).

6.1. Analytical hierarchy process applications

Several recent studies have applied Analytical Hierarchy Process (AHP) methodologies to distance education quality assessment. This approach enables systematic prioritization of quality factors through pairwise comparisons. Wen [60] developed a model for evaluating teaching quality in college distance education using AHP from the

Table 4
Comparative analysis of recent distance education quality frameworks.

Framework	Origin	Key dimensions	Unique contributions
PDPP evaluation model [66]	Hong Kong	• Planning (market demand, feasibility) • Development (instructional design, materials) • Process (technical support, interaction) • Product (student satisfaction, outcomes)	Process-oriented approach that addresses both preparation and implementation phases
Hierarchy-based analysis approach [63]	China	• Behavioral engagement • Emotional engagement • Cognitive engagement • Machine learning evaluation	Data-driven approach using gradient boosting to prioritize dimensions of student engagement
PADICA model [53]	Thailand	• Planning, Analysis, Designing • Improvement, Confirmation, Application • Focus on "four Cs": critical thinking, creativity, communication, collaboration	Competency-based approach specifically designed for post-pandemic contexts
Continuous assessment model [28] (figure 1)	China	• 14 quality dimensions • 75 quality indicators • International expert validation	Comprehensive assessment system validated across multiple countries
Pandemic-responsive framework [10]	Lithuania	• Strategy and management • IT infrastructure • Digital content and competencies • Teaching in digital environments • Support systems and partnerships	Holistic school transformation approach derived from pandemic experiences
Institutional resilience framework [39]	Australia/ China	• Crisis management • Leadership • Technological agility • Stakeholder communication • Adaptation mechanisms	Crisis-focused approach addressing institutional capacity for quality maintenance during disruptions
Data mining quality evaluation [41]	China	• Quality index system • Dimensionless processing • Rough set theory • Data-driven evaluation	Computational approach with high accuracy and efficiency metrics
Fuzzy AHP evaluation [15]	China	• Analytical Hierarchy Process • Fuzzy theory integration • Comprehensive index system • University-specific metrics	Combines mathematical precision with accommodation of evaluation uncertainty
PET-D framework [56]	Indonesia	• Pedagogy dimension • Evaluation dimension • Technology dimension • Student engagement metrics	Empirically validated in COVID-19 context with a specific focus on dimensional integration
Revised ODeL agenda [4]	South Africa	• Student-centered approach • Appropriate technologies • Capacity support • Assessment processes • Curriculum revision	Connectivism-based approach addressing post-school education and training

perspectives of students, peers, and supervisors. The model calculates weight values for various quality indicators and verifies consistency across evaluations. Similarly, Yin [64] proposed an AHP-based framework for accurately evaluating network distance education quality, achieving evaluation accuracy exceeding 95%.

Gao and Ge [15] further refined this approach by combining AHP with fuzzy theory to accommodate the inherent uncertainty in quality evaluations. Their method establishes a comprehensive quality evaluation system for university remote education, with evaluation index weights calculated through fuzzy AHP. Experimental results demonstrated high accuracy (over 95%) with low computational costs, making this approach both rigorous and practical for institutional implementation.

6.2. Data mining and machine learning approaches

Emerging approaches leverage data mining and machine learning techniques to enhance quality assessment. Pan [41] developed a method using data mining to evaluate multimedia distance education quality. Their approach establishes a quality index system under principles of integrity, pertinence, accuracy, representativeness, objectivity, and comparability. After normalizing evaluation indices through dimensionless processing, weights are calculated using rough set theory. The resulting evaluation demonstrated 100% accuracy with processing times under 8 seconds, suggesting significant potential for data-driven quality assessment.

Rani and Senthil [46] focused specifically on data-driven student engagement analysis in COVID-19 adaptive e-learning. Their research revealed significant increases in online discussion participation (10%), assignment submissions (15%), and learning management system usage (20%) among students using adaptive platforms. Regression analysis confirmed substantial correlations ($p < 0.001$) between adaptive e-learning utilization and increased engagement, highlighting the value of data-driven approaches for assessing specific quality dimensions.

6.3. Formative assessment methodologies

Formative assessment has emerged as a crucial component of quality assurance in distance education. Liu and Mu [30] argue that formative assessment is essential for monitoring and improving learning quality in distance settings. Their research proposes a system based on a fuzzy evaluation that places learners at the centre, enabling monitoring and adjustments throughout the learning process. This approach provides students with a direct understanding of their learning progress and facilitates timely interventions to enhance quality.

Montenegro-Rueda et al. [37] conducted a systematic review of assessment in higher education during the COVID-19 pandemic, analyzing 13 studies from 51 candidates. Their findings highlighted faculty challenges related to insufficient training in online assessment techniques and student issues, including academic dishonesty. The researchers concluded that continuous assessment approaches focusing on qualitative dimensions rather than examination-centred methods were most effective in distance contexts.

6.4. Comprehensive evaluation frameworks

Several researchers have developed comprehensive evaluation frameworks that integrate multiple methodological approaches. Li [28] proposed a model for continuous assessment of distance education program quality in online environments, identifying 14 dimensions and 75 indicators validated by experts from seven countries. The model enables holistic quality assessment with particular attention to teaching quality, providing a foundation for targeted improvement efforts.

Gaftandzhieva, Doneva and Jagatheesaperumal [14] conducted a state-of-play analysis of approaches and tools for quality assurance in distance learning. Their research

identified essential requirements for establishing distance learning quality and mapped diverse assessment tools, including course evaluations, self-assessments, and external reviews. The authors emphasized the importance of regulatory documents, stakeholder satisfaction measures, and performance indicators in comprehensive quality assessment.

Lopez-Chila et al. [31] evaluated the effectiveness of questionnaire tools in virtual learning environments for e-learning assessment. Using the PRISMA methodology, they analyzed recent research and surveyed 143 teachers to identify effective evaluation methods. Their findings confirmed that online assessment through questionnaire tools effectively supports learning outcomes when properly designed and implemented.

These methodological approaches demonstrate the evolution of quality assessment in distance education toward more sophisticated, multi-method frameworks that integrate quantitative and qualitative dimensions (table 5). They reflect growing recognition that quality assessment must be contextually sensitive, methodologically rigorous, and practically oriented toward continuous improvement.

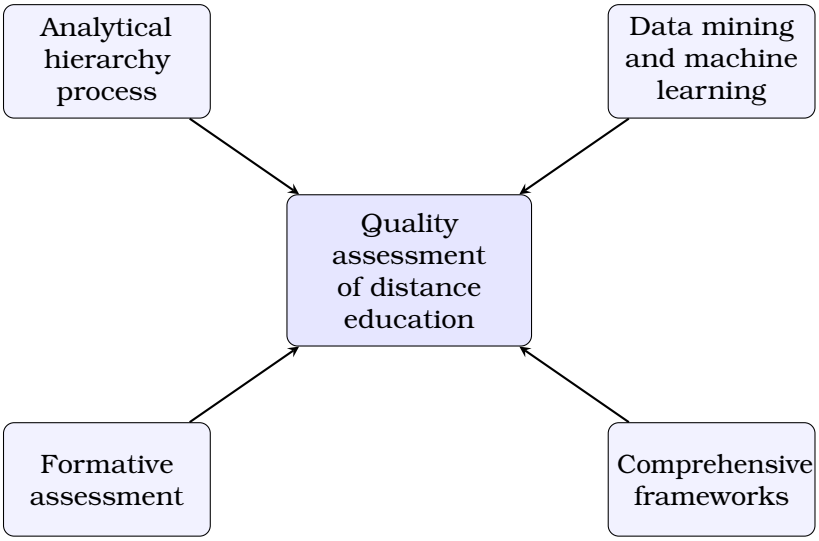

Figure 2: Methodological approaches to quality assessment in distance education.

7. Post-pandemic shifts in distance education quality

The COVID-19 pandemic catalyzed unprecedented changes in educational delivery worldwide, with distance education shifting from a supplementary option to a primary modality for millions of students. This massive, unplanned experiment revealed both strengths and weaknesses in existing quality approaches while accelerating innovation in quality frameworks. As educational systems transition to post-pandemic models, several key shifts in quality conceptualization and assessment have emerged (figure 3).

7.1. From emergency response to strategic design

Initial pandemic responses necessitated rapid transitions to emergency remote teaching, often prioritizing continuity over quality considerations. Nicol and Bice [39] documented Tsinghua University's experience as the first major university to move all courses online, highlighting the importance of crisis management and institutional resilience in maintaining quality during emergency transitions. Their analysis identified the critical role of leadership and adaptive decision-making in sustaining educational quality under extraordinary circumstances.

As institutions moved beyond emergency responses, more strategic approaches to quality emerged. Habala and Demlová [18] analyzed lessons from distance education

Table 5
Methodological approaches to quality assessment in distance education.

Methodology	Key features	Data collection methods	Strengths/Limitations
Analytical hierarchy process [15, 60, 64]	Hierarchical organization of quality factors; pairwise comparisons; priority weighting; consistency verification	Expert surveys; stakeholder questionnaires; institutional data	*Strengths:* systematic; quantifiable; comprehensive *Limitations:* complex implementation; expert dependency
Data mining and machine learning [41, 46]	Big data processing; pattern recognition; predictive analytics; adaptive algorithms	Learning management system logs; assessment data; engagement metrics; student performance indicators	*Strengths:* high accuracy; objective; scalable *Limitations:* technical complexity; data privacy concerns
Formative assessment [30, 37]	Continuous monitoring; learner-centered approach; adaptive intervention; process orientation	Ongoing assessments; student feedback; instructor observations; learning analytics	*Strengths:* dynamic; personalized; improvement-focused *Limitations:* resource-intensive; standardization challenges
Comprehensive evaluation frameworks [14, 28]	Multi-dimensional indicators; stakeholder integration; regulatory alignment; performance metrics	Expert validation; institutional audits; student surveys; regulatory reviews	*Strengths:* holistic; institutionally adaptable; standards-aligned *Limitations:* implementation complexity; contextual variability
Questionnaire-based assessment [31, 42]	Structured instruments; satisfaction metrics; comparative analysis; stakeholder perspectives	Student surveys; faculty feedback; administrator reviews; institutional data	*Strengths:* implementable; comparable; stakeholder-inclusive *Limitations:* subjective elements; response biases
Blended learning quality assessment [38, 63]	Hybrid format evaluation; engagement analysis; modality effectiveness; comparative metrics	Engagement analytics; performance comparisons; student surveys; experimental designs	*Strengths:* modality-sensitive; contextually relevant; future-oriented *Limitations:* complexity of isolating factors; implementation variability
Systematic reviews and meta-analyses [1, 37]	Literature synthesis; evidence aggregation; methodological assessment; comparative analysis	Database searches; inclusion/exclusion criteria; quality assessment tools; data extraction protocols	*Strengths:* evidence-based; comprehensive; methodology-focused *Limitations:* publication bias; methodological heterogeneity

during the pandemic, identifying transferable practices for improving both remote and on-site education. Their case study revealed significant value in maintaining certain distance education tools and approaches even after returning to physical campuses, suggesting a hybrid model as the optimal approach for future quality enhancement.

This strategic reframing reflects broader shifts in how quality is conceptualized post-pandemic. Aluko, Krull and Mhlanga [4] argue for a revised agenda in open, distance, and e-learning based on three pillars: questioning traditional beliefs about learning and teaching, curriculum responsiveness to knowledge society demands, and

robust quality assurance mechanisms. Their framework emphasizes the importance of student-centred approaches, appropriate technologies, capacity building, rigorous assessment processes, and regular curriculum renewal – representing a comprehensive reconceptualization of quality in post-pandemic contexts.

7.2. Evolving stakeholder perspectives

The pandemic revealed diverse stakeholder experiences with distance education, prompting more nuanced attention to different perspectives in quality frameworks. Tyurikov et al. [57] surveyed students and teachers at Russian universities regarding trust in distance learning during the pandemic. Their findings indicated that while remote formats did not cause sharp declines in education quality, students maintained preferences for traditional educational forms. The researchers identified factors shaping student readiness for distance education, including course of study, funding models, and training direction.

Similarly, Mohammed Albanyan [36] examined Saudi university students' perspectives on distance learning quality during COVID-19, identifying five quality axes with varying levels of satisfaction. The interactive axis received the highest ratings, while the evaluation axis scored lowest, suggesting specific areas for quality improvement. Students valued live lessons and interactions while acknowledging the utility of distance education during the pandemic, highlighting the complex and sometimes contradictory nature of stakeholder assessments.

Advilonienė [2] investigated prerequisites for integrating face-to-face and distance teaching in virtual spaces based on student perspectives. Their research revealed support for blended learning models in higher education but resistance to purely distance formats. These findings suggest that quality frameworks must accommodate hybrid approaches that combine the strengths of both modalities while mitigating their respective limitations.

7.3. Technological integration and innovation

Technological dimensions of quality have evolved significantly post-pandemic, with greater emphasis on selecting appropriate tools and platforms for specific educational contexts. Litvishko et al. [29] analyzed digital tools in post-pandemic education, identifying innovations worth incorporating into regular teaching practices. Their research demonstrates that not all digital techniques employed during emergency remote teaching merit continuation, emphasizing the importance of selective integration based on demonstrable quality improvements.

Dzedik et al. [11] highlight more advanced technological integration, examining how artificial intelligence methods can enhance quality management systems in educational organizations. Their research documents significant opportunities for systemic AI integration across administrative, scientific, educational, and auxiliary processes. This approach represents a qualitative shift from viewing technology as merely enabling distance education to recognizing its potential for fundamentally transforming quality assurance processes.

The post-pandemic landscape has also witnessed growing attention to adaptive e-learning approaches. Rani and Senthil [46] demonstrate how data-driven analysis of student engagement in adaptive e-learning environments can enhance quality assessment and improvement. Their findings suggest that personalized, responsive learning environments yield measurable improvements in student engagement and outcomes, pointing toward more sophisticated quality frameworks that incorporate adaptability and personalization dimensions.

7.4. Resilience and sustainability as quality indicators

Perhaps the most significant post-pandemic shift involves the recognition of resilience and sustainability as core quality indicators. Bork-Hüffer et al. [6] investigated university students' perceptions of distance learning during the pandemic in Austria, identifying both immediate adaptations and implications for post-pandemic educational futures. Their findings highlight the importance of developing resilient educational systems capable of maintaining quality through disruptions while suggesting significant changes in post-pandemic education adapted to an increasingly digital environment.

This emphasis on resilience extends to faculty development and support systems. Sukhikh et al. [52] surveyed medical students regarding education during the pandemic, finding that while distance learning enabled educational continuity, it created significant stress for both students and teachers. Their research underscores the importance of social support measures to reduce academic burnout and enhance psychological resilience as components of educational quality.

Daukšienė, Trepulė and Naujokaitienė [10] identified eight school activity areas requiring modification during the transition to distance teaching and learning: strategy and management, IT infrastructure, digital content, digital competencies and professional development, teaching and assessment in digital environments, support systems, partnerships, and quality assurance. Their findings suggest that comprehensive quality frameworks must address all these dimensions to ensure resilience and sustainability in distance education offerings.

These post-pandemic shifts collectively point toward more holistic, adaptive quality frameworks that balance technological capabilities with human needs, institutional capacities with stakeholder expectations, and immediate responses with long-term sustainability. They suggest that quality in distance education increasingly involves not just meeting predetermined standards but building adaptive capacity to maintain educational effectiveness through changing circumstances.

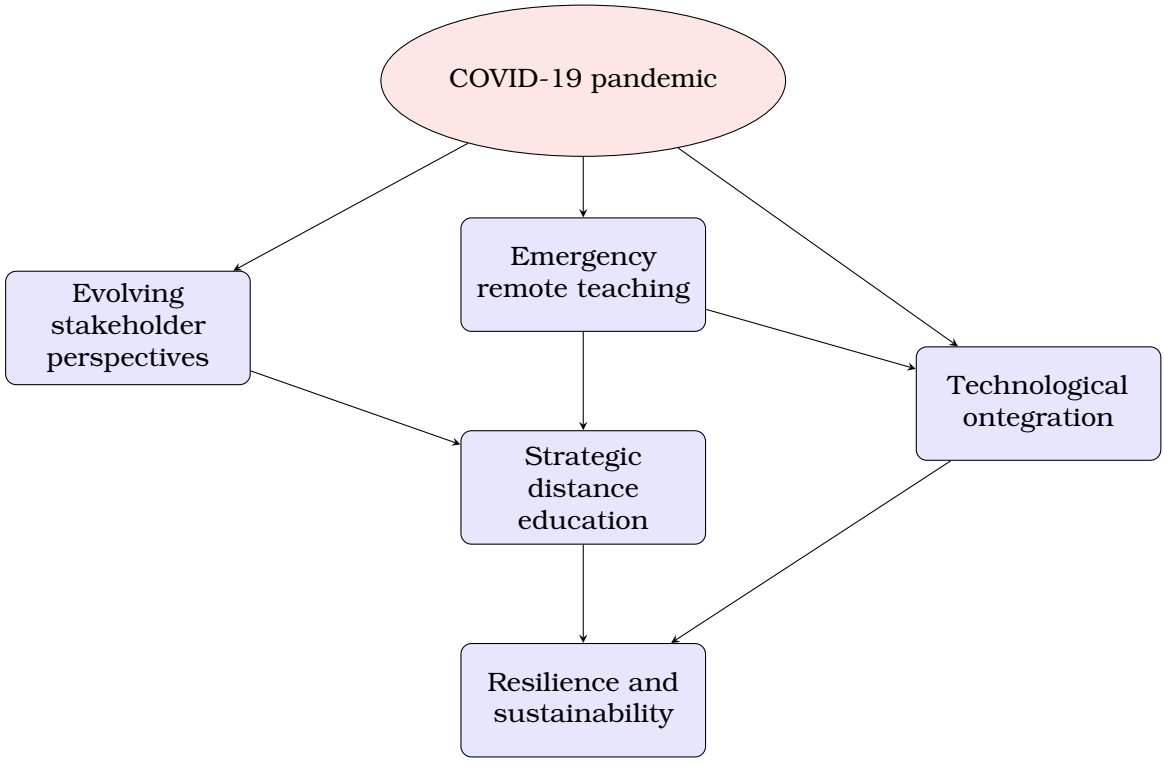

Figure 3: Evolution of distance education quality frameworks post-pandemic.

8. Practical implementation for educational institutions

Translating theoretical quality frameworks into practical implementation strategies represents a significant challenge for educational institutions. Recent research offers evidence-based approaches for implementing quality assurance in distance education across diverse institutional contexts.

8.1. Strategic planning and policy development

Effective implementation begins with comprehensive strategic planning and policy development. Malik [33] identifies several strategies for maintaining quality in distance higher education, emphasizing the importance of policy frameworks that address curriculum, instruction, support services, faculty development, and technological infrastructure. These strategies include:

1. Developing comprehensive quality assurance policies aligned with institutional missions
2. Establishing internal quality assurance units with clear responsibilities and authority
3. Creating codes of ethics for distance education faculty and students
4. Ensuring programs receive approval from national accreditation councils
5. Implementing regular quality checks at each stage of program delivery

Gaftandzhieva, Doneva and Jagatheesaperumal [14] further emphasize the importance of regulatory documents and manuals that establish clear quality standards and procedures. Their research suggests that formal quality frameworks provide essential structure for implementation efforts while ensuring alignment with broader institutional and national quality expectations.

These strategic approaches should be contextually sensitive while maintaining core quality principles. Polinkevych, Khovrak and Trynchuk [45] document how Ukrainian institutions adapted quality management approaches during wartime conditions, highlighting the importance of flexible implementation strategies that respond to specific institutional challenges and constraints.

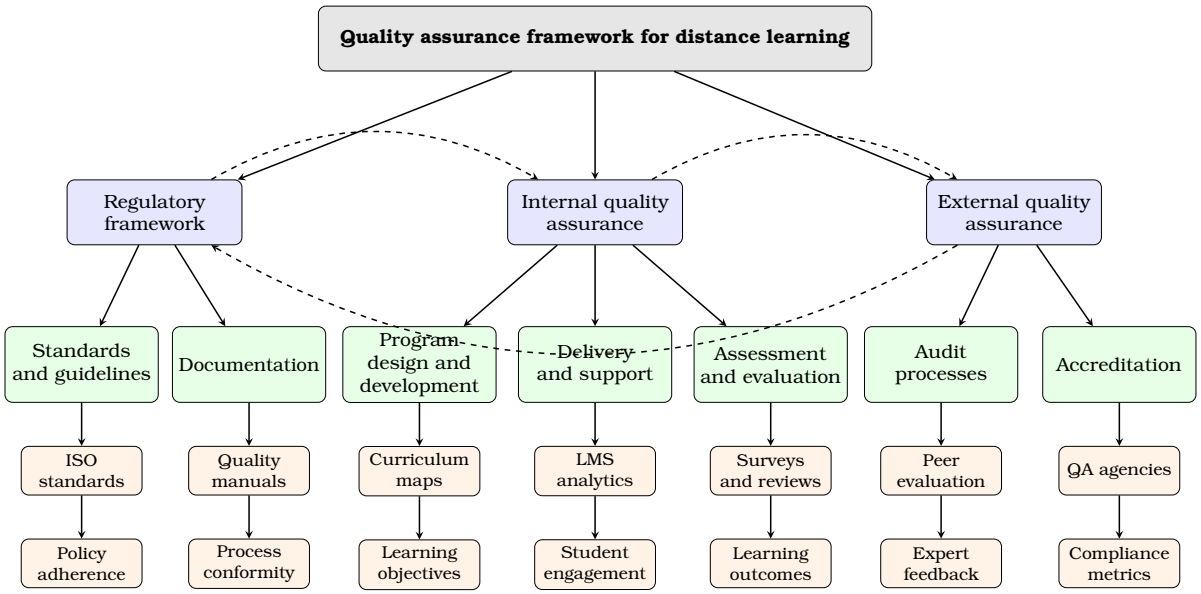

Figure 4: Hierarchical structure of quality assurance components, tools and indicators for distance learning (adapted from Gaftandzhieva, Doneva and Jagatheesaperumal [14]).

Figure 4 presents a hierarchical structure of quality assurance components for distance learning, showing the relationship between regulatory frameworks, internal quality assurance mechanisms, and external quality assurance processes. It includes specific tools and performance indicators at each level, illustrating how these components integrate into a comprehensive quality assurance system.

8.2. Faculty development and support

Faculty development represents a critical implementation dimension, as instructor preparation significantly impacts distance education quality. Mentsiev, Dauletukaeva and Aygumov [35] identify effective methods for increasing professional skills in distance learning, emphasizing that teacher quality is essential to overall program quality. Their research highlights the importance of developing digital competencies that extend beyond basic technological proficiency to encompass pedagogical applications and assessment strategies.

Daukšienė, Trepulė and Naujokaitienė [10] document the first lessons learned by schools during the pandemic transition, finding that digital competencies and continuous professional development were among the most successfully addressed areas. Their research suggests that focused faculty development initiatives can yield relatively rapid quality improvements when properly designed and resourced.

Implementation strategies should address both technical and pedagogical dimensions of faculty preparation. Yan, Jiang and Chen [62] identify common problems in network curriculum implementation, including single teaching content forms, weak learning environment design, and inadequate teaching activities. Their proposed solutions emphasize enhanced instructional design from learner perspectives, guided by educational theory and focused on application-oriented curricula.

8.3. Technological infrastructure and tools

Quality implementation requires appropriate technological infrastructure and tools. Kose [25] outlines future directions for intelligent web-based e-learning, emphasizing the importance of selecting and integrating technologies that enhance learning rather than simply digitizing traditional approaches. This perspective suggests that technological implementations should be driven by pedagogical considerations rather than technological availability.

Papanikolaou [43] documents the implementation of Google Suite for Education in engineering courses, finding strong correlations between performance on weekly online assessments and final course outcomes. This case study demonstrates how integrated online systems for homework, quizzes, virtual lectures, and office hours can enhance quality through the consistent application of well-designed technological tools.

Effective implementation often involves selective adoption rather than comprehensive technological transformation. Litvishko et al. [29] analyzed digital tools in post-pandemic education and concluded that institutions should carefully evaluate which technologies genuinely enhance learning quality rather than implementing digital approaches indiscriminately. This selective approach enables more focused resource allocation and faculty development efforts.

8.4. Quality monitoring and continuous improvement

Sustainable quality implementation requires robust monitoring and continuous improvement processes. Li [28] developed a model for continuous assessment of distance education program quality that enables holistic evaluation across 14 dimensions and 75 indicators. This comprehensive approach provides detailed insights for targeted quality improvements while maintaining a holistic perspective on program quality.

Pangarso and Setyorini [42] identified drivers of e-learning satisfaction during the early pandemic, finding that social presence, confirmation of expectations, and student-student interaction significantly influenced satisfaction levels. Their research highlights the importance of monitoring these social dimensions alongside more technical quality indicators, suggesting a balanced approach to quality assessment.

Implementation should incorporate feedback loops that enable ongoing refinement of distance education offerings. Bork-Hüffer et al. [6] found that despite students' desire to return to face-to-face teaching for social benefits, over half wanted to maintain distance education options post-pandemic. This finding suggests that implementation strategies should maintain flexibility and responsiveness to diverse student preferences rather than pursuing single, standardized approaches.

8.5. Contextually sensitive implementation

Finally, implementation strategies must be sensitive to specific educational contexts. Theerathammakorn, Soontornchai and Amornrit [53] developed a competency-based learning model for distance education in sustainable manufacturing systems, demonstrating how discipline-specific quality approaches can enhance learning outcomes. Their PADICA model achieved significant improvements in critical thinking and creative skills by aligning distance education approaches with industry needs and gradual competency development.

Ye et al. [63] conducted a hierarchy-based analysis of blended learning with Chinese students, finding that cognitive and emotional engagement was more important than behavioural engagement in predicting learning quality. This research highlights the importance of cultural and contextual factors in quality implementation, suggesting that strategies effective in one context may require adaptation for others.

These implementation approaches suggest that effective quality assurance in distance education requires comprehensive strategic planning, robust faculty development, appropriate technological infrastructure, continuous monitoring and improvement, and contextual sensitivity (table 6). Institutions that address these dimensions systematically while maintaining flexibility to address emerging challenges are most likely to achieve and sustain high-quality distance education offerings.

9. Conclusions and future directions

The concept of educational quality has been studied for decades, evolving to address changing educational contexts and stakeholder expectations. In recent years, increasing attention has focused on the quality of distance education, a trend accelerated by the COVID-19 pandemic's dramatic expansion of remote learning worldwide. Our systematic review of approaches to quality in distance education reveals several key findings with implications for research, practice, and policy.

First, quality assurance in distance education has matured from primarily technology-focused approaches to multidimensional frameworks that balance technological, pedagogical, social, and organizational considerations. Early frameworks like the Online Learning Consortium's Five Pillars established important foundations, but recent developments demonstrate increasing sophistication in how quality is conceptualized and assessed. Models such as the PDPP evaluation framework, hierarchy-based analysis approaches, competency-based learning models, and unified quality control systems reflect this evolution toward more comprehensive quality assurance.

Second, methodological approaches to quality assessment have diversified significantly, incorporating analytical hierarchy processes, data mining techniques, formative assessment methodologies, and comprehensive evaluation frameworks. These approaches enable more rigorous, evidence-based quality assurance while accommodating the complexity and contextuality of distance education environments. The

Table 6
Implementation framework for quality assurance in distance education.

Implementation area	Key strategies	Primary references
Strategic planning	• Develop comprehensive quality assurance policies • Establish internal quality units • Create ethical guidelines • Ensure accreditation approval • Implement regular quality checks	Malik [33] Gaftandzhieva, Doneva and Jagatheesaperumal [14] Polinkevych, Khovrak and Trynchuk [45]
Faculty development	• Focus on digital teaching competencies • Balance technical and pedagogical training • Develop assessment capabilities • Create communities of practice • Provide ongoing support	Mentsiev, Dauletukaeva and Aygumov [35] Daukšienė, Trepulė and Naujokaitienė [10] Yan, Jiang and Chen [62]
Technology integration	• Select tools based on pedagogical goals • Implement integrated learning platforms • Ensure accessibility and usability • Maintain reliable infrastructure • Adopt intelligent learning technologies	Kose [25] Papanikolaou [43] Litvishko et al. [29]
Quality monitoring	• Implement comprehensive assessment models • Monitor technical and social dimensions • Establish feedback mechanisms • Maintain flexibility in approaches • Conduct regular stakeholder surveys	Li [28] Pangarso and Setyorini [42] Bork-Hüffer et al. [6]
Contextual adaptation	• Develop discipline-specific approaches • Consider cultural factors • Address diverse student needs • Align with industry requirements • Adapt to institutional constraints	Theerathammakorn, Soontornchai and Amornrit [53] Ye et al. [63] Sukhikh et al. [52]

integration of qualitative and quantitative methodologies supports a more nuanced understanding of quality dimensions that may not be captured through traditional assessment approaches.

Third, the COVID-19 pandemic has catalyzed significant shifts in distance education quality frameworks, moving from emergency response to strategic design, expanding stakeholder perspectives, advancing technological integration, and highlighting resilience and sustainability as quality indicators. These shifts suggest that future quality frameworks must address not only traditional dimensions like learning effectiveness and student satisfaction but also institutional adaptability, technological agility, and sustainable implementation strategies.

Fourth, practical implementation of quality assurance in distance education requires comprehensive attention to strategic planning, faculty development, technological infrastructure, quality monitoring, and contextual adaptation. Institutions that systematically address these dimensions while maintaining flexibility to respond to

emerging challenges are best positioned to develop and sustain high-quality distance education offerings.

Several directions for future research emerge from these findings. First, longitudinal studies of distance education quality across multiple pandemic and post-pandemic phases would provide valuable insights into the durability and adaptability of various quality approaches. Second, comparative research examining quality implementation across diverse institutional contexts could identify contextual factors that influence quality assurance effectiveness. Third, studies exploring the integration of artificial intelligence and other emerging technologies into quality frameworks could advance understanding of how technological innovation might enhance quality assessment and improvement.

Finally, research investigating the relationship between specific quality dimensions and student outcomes would strengthen the empirical foundation for quality frameworks. While many studies document stakeholder perceptions of quality, fewer establish clear connections between quality indicators and measurable learning outcomes. Addressing this gap would enhance the validity and utility of quality frameworks while potentially identifying the most impactful areas for quality improvement efforts.

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