

---

Postgraduate Certificate in EdTech and AI in Education

## Research Methods in EdTech

---

### Action Research

Related terms: case study, iterative design, reflective practice.

Explanation: A cyclical method where practitioners identify a problem, implement an intervention, collect data, reflect, and refine the approach.

Example: A teacher modifies a digital quiz platform after each class based on student performance data.

Application: Improves instructional design of learning management systems (LMS) by grounding changes in real-time feedback.

Challenges: Requires time-intensive data collection and may suffer from researcher bias if not carefully documented.

### Adaptive Learning

Related terms: personalization, algorithmic tutoring, learner analytics.

Explanation: Technology that adjusts content, pacing, or pathways according to each learner's demonstrated knowledge and skill level.

Example: An AI-driven math app presents easier problems after a series of incorrect answers.

Application: Enhances mastery learning in MOOCs by providing tailored remediation.

Challenges: Designing accurate adaptation algorithms and ensuring equity across diverse learner populations.

### A/B Testing

Related terms: split testing, experimental design, statistical significance.

Explanation: A controlled experiment that compares two versions of a digital artifact to determine which performs better on a defined metric.

Example: Testing two layouts of an online discussion forum to see which yields higher participation rates.

Application: Optimizes user interface (UI) elements of educational apps for engagement.

Challenges: Requires sufficient sample size and careful randomization to avoid confounding variables.

### Analytics Dashboard

Related terms: learning analytics, data visualization, key performance indicators (KPIs).

Explanation: A visual interface that aggregates and displays metrics such as completion rates, time on task, and assessment scores.

Example: A university's LMS dashboard shows departmental average quiz scores across semesters.

Application: Supports data-driven decision making for curriculum improvement.

Challenges: Overreliance on superficial metrics may mask deeper learning issues; data privacy must be safeguarded.

### Artificial Intelligence (AI)

Related terms: machine learning, natural language processing, intelligent tutoring systems.

Explanation: Computational techniques that enable machines to mimic human cognition, such as pattern recognition, prediction, and language understanding.

Example: An AI chatbot provides instant feedback on short-answer questions.

Application: Automates grading, personalizes content, and predicts student at-risk status.

Challenges: Algorithmic bias, transparency, and the need for large, high-quality training datasets.

#### Attribution Modeling

Related terms: causal inference, multivariate analysis, conversion tracking.

Explanation: A statistical approach that assigns credit to multiple touchpoints influencing a learner's outcome.

Example: Determining how webinars, email reminders, and in-app notifications collectively affect course completion.

Application: Guides resource allocation for effective learner support interventions.

Challenges: Complex interaction effects and data fragmentation across platforms.

#### Bayesian Inference

Related terms: prior probability, posterior distribution, hierarchical modeling.

Explanation: A probabilistic framework that updates beliefs about a parameter as new evidence becomes available.

Example: Updating the estimated difficulty of a quiz item after each cohort's responses.

Application: Enables dynamic assessment calibration in adaptive testing.

Challenges: Requires computational expertise and careful selection of priors to avoid misleading results.

#### Blended Learning

Related terms: hybrid instruction, flipped classroom, synchronous/asynchronous modes.

Explanation: An instructional design that combines face-to-face teaching with digital learning activities.

Example: Students watch recorded lectures online, then engage in in-person problem-solving sessions.

Application: Increases flexibility while preserving social interaction.

Challenges: Aligning online and offline components to avoid redundancy or gaps.

#### Bloom's Taxonomy

Related terms: cognitive domain, learning outcomes, assessment rubrics.

Explanation: A hierarchical classification of learning objectives ranging from remembering to creating.

Example: Designing a project where learners must synthesize research findings into a novel application.

Application: Guides the development of assessment items aligned with desired cognitive levels.

Challenges: Over-reliance on lower-order skills can limit higher-order thinking opportunities.

#### Cluster Analysis

Related terms: segmentation, unsupervised learning, k-means.

Explanation: A statistical technique that groups learners based on similarity across multiple variables.

Example: Identifying a cluster of students who frequently access multimedia resources but score low on assessments.

Application: Targets interventions to specific learner sub-populations.

Challenges: Determining the optimal number of clusters and interpreting them meaningfully.

### Collaborative Filtering

Related terms: recommendation systems, similarity metrics, user-based filtering.

Explanation: An algorithmic method that suggests items to a learner based on the preferences of similar users.

Example: Suggesting supplemental videos to a student because peers with comparable profiles found them helpful.

Application: Personalizes resource recommendations in digital libraries.

Challenges: Cold-start problem for new users and potential reinforcement of echo chambers.

### Content Analysis

Related terms: coding scheme, thematic analysis, qualitative data.

Explanation: A systematic process of categorizing textual or multimedia data to identify patterns or themes.

Example: Coding forum posts to assess the prevalence of self-efficacy statements.

Application: Evaluates affective dimensions of learner interaction.

Challenges: Requires reliable coding protocols and can be time-consuming.

### Construct Validity

Related terms: measurement theory, content validity, convergent validity.

Explanation: The degree to which a test accurately measures the theoretical construct it intends to assess.

Example: Validating that a digital game measures problem-solving rather than merely reaction time.

Application: Ensures that research findings reflect genuine learning outcomes.

Challenges: Requires rigorous theoretical grounding and empirical testing.

### Curriculum Mapping

Related terms: alignment, learning objectives, instructional design.

Explanation: The process of visually linking standards, objectives, assessments, and instructional activities across a program.

Example: Mapping digital literacy competencies to specific modules in an online teacher-training course.

Application: Identifies gaps and redundancies in program design.

Challenges: Maintaining up-to-date maps as curricula evolve.

### Data Triangulation

Related terms: mixed methods, convergence, methodological pluralism.

Explanation: Combining multiple data sources or methods to corroborate findings and enhance credibility.

Example: Merging clickstream logs, survey responses, and interview transcripts to evaluate a learning analytics tool.

Application: Provides a richer, more robust understanding of learner behavior.

Challenges: Integrating disparate data formats and resolving conflicting evidence.

### Design-Based Research (DBR)

Related terms: interventionist research, iterative prototyping, theory development.

Explanation: A collaborative approach that designs, implements, and studies educational interventions in real settings to refine theory and practice.

Example: Developing a gamified feedback system, testing it across semesters, and revising design based on

emergent data.

Application: Bridges the gap between laboratory research and classroom practice.

Challenges: Managing complexity of real-world contexts and ensuring methodological rigor.

### Digital Divide

Related terms: equity, access disparity, broadband availability.

Explanation: The gap between individuals or groups who have adequate access to digital technologies and those who do not.

Example: Rural students lacking high-speed internet experience lower participation in synchronous webinars.

Application: Informs policy decisions on infrastructure investment and inclusive design.

Challenges: Multifaceted nature involving socioeconomic, geographic, and cultural factors.

### Ecological Validity

Related terms: external validity, real-world setting, generalizability.

Explanation: The extent to which research findings can be applied to everyday educational environments.

Example: Testing an AI tutor in a lab versus deploying it across multiple schools.

Application: Increases confidence that interventions will function outside controlled settings.

Challenges: Balancing experimental control with authentic contexts.

### Effect Size

Related terms: Cohen's  $d$ , standardized mean difference, statistical power.

Explanation: A quantitative measure of the magnitude of a treatment's impact, independent of sample size.

Example: Reporting that a new interactive module yields a medium effect ( $d = 0.5$ ) on post-test scores.

Application: Facilitates comparison across studies and informs meta-analysis.

Challenges: Interpreting practical significance and ensuring appropriate calculation.

### Ethnography

Related terms: participant observation, cultural analysis, qualitative immersion.

Explanation: An in-depth qualitative method that explores learners' lived experiences within their natural contexts.

Example: Observing how teachers integrate a virtual reality (VR) simulation into daily lessons.

Application: Generates nuanced insights into technology adoption processes.

Challenges: Time-intensive, requires reflexivity, and may raise privacy concerns.

### Exploratory Factor Analysis (EFA)

Related terms: latent variables, dimensionality reduction, principal component analysis.

Explanation: A statistical technique used to uncover underlying factor structures among observed variables.

Example: Identifying three latent dimensions—cognitive, affective, and behavioral engagement—from questionnaire items.

Application: Helps refine measurement instruments for EdTech research.

Challenges: Requires large sample sizes and careful interpretation of factor loadings.

### Feedback Loop

Related terms: formative assessment, adaptive systems, iterative improvement.

Explanation: A cycle where learner performance data informs immediate instructional adjustments, which in turn generate new data.

Example: An AI tutor provides hints after each incorrect answer, then updates its model of the learner's misconceptions.

Application: Supports personalized learning pathways.

Challenges: Designing timely and pedagogically sound feedback without overwhelming learners.

### Flipped Classroom

Related terms: inverted pedagogy, pre-class preparation, active learning.

Explanation: A model where learners first encounter instructional content outside class (e.g., via video) and use class time for applied activities.

Example: Students watch a tutorial on coding syntax at home, then collaborate on debugging exercises in class.

Application: Maximizes higher-order learning during face-to-face sessions.

Challenges: Requires reliable access to pre-class materials and learner accountability.

### Framework for Learning Analytics (FLA)

Related terms: data governance, ethical principles, stakeholder model.

Explanation: A structured set of guidelines that outlines the collection, analysis, and use of learning data within an institution.

Example: Implementing a policy that mandates anonymization of student interaction logs before analysis.

Application: Provides a roadmap for responsible analytics deployment.

Challenges: Balancing transparency with privacy, and aligning diverse stakeholder expectations.

### Growth Mindset Intervention

Related terms: mindset theory, self-efficacy, attitude change.

Explanation: An instructional strategy designed to foster the belief that abilities can be developed through effort and strategies.

Example: Embedding short videos that emphasize neuroplasticity before a challenging assessment.

Application: Improves resilience and persistence in technology-rich learning environments.

Challenges: Measuring attitudinal shifts and ensuring sustained impact.

### Heuristic Evaluation

Related terms: usability testing, cognitive walkthrough, expert review.

Explanation: A usability inspection method where experts assess an interface against established design principles (heuristics).

Example: Evaluating a learning portal for consistency, error prevention, and user control.

Application: Identifies design flaws early in development.

Challenges: Depends on evaluator expertise and may miss context-specific issues.

### Hybrid Research Design

Related terms: mixed methods, convergent parallel, explanatory sequential.

Explanation: A research approach that combines quantitative and qualitative components within a single

study to leverage strengths of both.

Example: Conducting a survey on learner satisfaction while also holding focus groups to explore underlying reasons.

Application: Provides comprehensive insight into EdTech interventions.

Challenges: Requires careful integration of data strands and expertise in both paradigms.

#### Human-Centered Design (HCD)

Related terms: user experience (UX), participatory design, empathy mapping.

Explanation: A design philosophy that places learners' needs, contexts, and feedback at the core of technology development.

Example: Co-creating a mobile learning app with students through iterative prototyping sessions.

Application: Increases adoption and effectiveness of educational tools.

Challenges: Time-intensive stakeholder engagement and reconciling divergent user preferences.

#### Impact Evaluation

Related terms: outcome assessment, longitudinal study, counterfactual.

Explanation: Systematic assessment of the long-term effects of an intervention on targeted outcomes.

Example: Measuring graduate employment rates three years after completing an AI-enhanced curriculum.

Application: Informs policy decisions and funding allocations.

Challenges: Isolating the intervention's effect from external influences and maintaining participant tracking.

#### Incremental Validity

Related terms: predictive validity, criterion-related validity, hierarchical regression.

Explanation: The extent to which a new measure adds explanatory power beyond existing instruments.

Example: Demonstrating that a digital metacognition tracker predicts final grades above traditional quizzes.

Application: Justifies adoption of novel assessment tools.

Challenges: Requires robust statistical modeling and appropriate comparison baselines.

#### Infographic Literacy

Related terms: visual communication, data interpretation, multimodal literacy.

Explanation: The ability to decode, interpret, and critically evaluate information presented in infographic format.

Example: Assessing learners' capacity to extract key statistics from a research summary graphic.

Application: Supports development of critical data literacy in digital curricula.

Challenges: Varies with prior visual experience and cultural conventions.

#### Inter-rater Reliability

Related terms: Cohen's kappa, agreement coefficient, coding consistency.

Explanation: A metric that quantifies the degree of agreement between multiple coders rating the same data.

Example: Achieving a kappa of 0.78 when two researchers code discussion forum sentiments.

Application: Enhances credibility of qualitative analyses.

Challenges: Requires clear coding schemes and training to achieve high agreement.

### Iterative Prototyping

Related terms: rapid development, user testing, agile methodology.

Explanation: A cyclical process of creating, testing, and refining a prototype based on user feedback.

Example: Building successive versions of a virtual lab simulation, each incorporating learner suggestions.

Application: Accelerates design improvements and aligns product with learner needs.

Challenges: Managing scope creep and ensuring each iteration is sufficiently evaluated.

### Learning Analytics

Related terms: data mining, predictive modeling, educational data science.

Explanation: The measurement, collection, analysis, and reporting of data about learners and their contexts to improve learning.

Example: Predicting dropout risk using attendance, assignment submission, and forum participation data.

Application: Enables early warning systems and targeted support.

Challenges: Data quality, privacy concerns, and interpretation of complex metrics.

### Learning Management System (LMS)

Related terms: course delivery platform, SCORM, integration.

Explanation: A software application for the administration, documentation, tracking, reporting, and delivery of educational courses.

Example: Moodle hosting a blended course with quizzes, forums, and gradebooks.

Application: Centralizes instructional resources and learner data.

Challenges: Usability, scalability, and alignment with pedagogical goals.

### Learning Style Theory

Related terms: visual/auditory kinesthetic, learner preference, personalization.

Explanation: A contested framework suggesting that individuals learn best when instruction aligns with their preferred sensory modality.

Example: Offering both video and text explanations for a concept.

Application: Often used to justify differentiated resource provision.

Challenges: Empirical support is weak; over-reliance may limit instructional diversity.

### Latent Growth Modeling (LGM)

Related terms: longitudinal analysis, structural equation modeling, trajectory analysis.

Explanation: A statistical technique that models change over time at the individual level, capturing both initial status and growth rate.

Example: Tracking students' self-efficacy scores across five semesters to identify distinct growth patterns.

Application: Informs design of interventions that target specific phases of learner development.

Challenges: Requires multiple measurement points and sophisticated software.

### Mixed Methods

Related terms: triangulation, convergent design, qualitative-quantitative integration.

Explanation: An approach that deliberately combines both qualitative and quantitative data collection and analysis within a single study.

Example: Surveying 300 learners on satisfaction while conducting 20 in-depth interviews.

Application: Provides a richer, more nuanced understanding of EdTech impacts.

Challenges: Demands expertise in both paradigms and careful timing of data collection phases.

#### Multimodal Learning Analytics (MMLA)

Related terms: video analytics, eye-tracking, affect sensing.

Explanation: The analysis of data from multiple channels (e.g., audio, video, physiological sensors) to understand complex learning processes.

Example: Using facial expression detection to gauge frustration during a coding task.

Application: Offers deeper insights into affective and cognitive states.

Challenges: Technical integration, data storage, and ethical considerations around biometric data.

#### Neural Network

Related terms: deep learning, backpropagation, hidden layers.

Explanation: A computational model inspired by the brain's interconnected neurons, capable of learning complex patterns from data.

Example: A convolutional neural network classifies handwritten mathematical symbols.

Application: Powers advanced adaptive assessment and content recommendation systems.

Challenges: Opacity ("black-box" problem), large training data requirements, and computational cost.

#### Observational Study

Related terms: naturalistic observation, non-experimental design, field research.

Explanation: A research design that records behavior in real-world settings without manipulating variables.

Example: Monitoring how students interact with an AR app during a museum visit.

Application: Captures authentic usage patterns of educational technologies.

Challenges: Limited control over extraneous variables and potential observer bias.

#### Open Educational Resources (OER)

Related terms: open licensing, Creative Commons, resource sharing.

Explanation: Freely accessible teaching, learning, and research materials that can be adapted and redistributed.

Example: A university adopts a CC-BY textbook for an introductory AI course.

Application: Reduces cost barriers and promotes collaborative content creation.

Challenges: Ensuring quality, sustainability, and alignment with curriculum standards.

#### Ordinal Scale

Related terms: Likert scale, rank order, non-interval measurement.

Explanation: A measurement scale that reflects relative ordering of items but does not assume equal intervals between points.

Example: Survey items ranging from "Strongly disagree" to "Strongly agree."

Application: Commonly used in attitude and satisfaction questionnaires.

Challenges: Limits the types of statistical analyses that can be performed.

#### Participatory Design

Related terms: co-creation, stakeholder engagement, design workshops.

Explanation: A collaborative approach where end-users actively contribute to the design process of a technology.

Example: Teachers and students jointly designing the navigation structure of a new LMS module.

Application: Increases relevance and acceptance of EdTech solutions.

Challenges: Managing divergent ideas and ensuring equitable participation.

### Pedagogical Content Knowledge (PCK)

Related terms: teacher expertise, instructional strategies, subject matter integration.

Explanation: The intersection of content knowledge and pedagogy, enabling teachers to convey concepts effectively.

Example: Using a visual metaphor to explain recursion in programming.

Application: Guides professional development for technology-enhanced instruction.

Challenges: Translating PCK into digital formats without loss of nuance.

### Personal Learning Environment (PLE)

Related terms: learner agency, tool integration, self-directed learning.

Explanation: A set of tools, resources, and services that learners curate to support their own learning processes.

Example: A student's PLE includes a note-taking app, a curated YouTube playlist, and a citation manager.

Application: Encourages autonomy and lifelong learning habits.

Challenges: Requires digital literacy and may lead to fragmented experiences.

### Phenomenography

Related terms: variation theory, qualitative research, experience mapping.

Explanation: A research method that explores the different ways people experience or conceptualize a phenomenon.

Example: Identifying distinct ways teachers perceive the role of AI in assessment.

Application: Informs design of professional development programs.

Challenges: Requires rigorous interview techniques and careful categorization.

### Predictive Modeling

Related terms: regression analysis, machine learning, risk scoring.

Explanation: The use of statistical or algorithmic techniques to forecast future outcomes based on historical data.

Example: Predicting which students will achieve proficiency on a digital literacy test.

Application: Enables proactive interventions and resource allocation.

Challenges: Model overfitting, data drift, and interpretability concerns.

### Qualitative Coding

Related terms: thematic analysis, grounded theory, codebook.

Explanation: The systematic process of labeling segments of textual or visual data to identify patterns and themes.

Example: Coding chat transcripts for instances of collaborative problem solving.

Application: Provides depth to understanding of learner interactions.

Challenges: Labor-intensive and subject to coder bias.

#### Randomized Controlled Trial (RCT)

Related terms: experimental design, control group, random assignment.

Explanation: A study where participants are randomly allocated to either an intervention or a comparison condition to assess causal effects.

Example: Randomly assigning half of a cohort to receive an AI-driven tutoring system and half to a traditional textbook.

Application: Generates high-quality evidence on EdTech efficacy.

Challenges: Ethical considerations, logistical complexity, and participant attrition.

#### Rasch Modeling

Related terms: item response theory, measurement invariance, difficulty calibration.

Explanation: A probabilistic model that estimates both item difficulty and learner ability on a common scale.

Example: Calibrating quiz items so that a score of 70 indicates mastery of the underlying skill.

Application: Supports adaptive testing and fair assessment across diverse learners.

Challenges: Requires unidimensionality and sufficient response data.

#### Reflective Practice

Related terms: metacognition, professional learning, self-assessment.

Explanation: The habit of continuously analyzing one's own teaching actions to improve future performance.

Example: An instructor reviews analytics dashboards after each session to adjust pacing.

Application: Promotes continuous improvement in technology integration.

Challenges: Time constraints and need for supportive feedback mechanisms.

#### Remote Proctoring

Related terms: online invigilation, identity verification, privacy concerns.

Explanation: The use of technology to monitor exam takers remotely to ensure academic integrity.

Example: Using webcam and AI-based facial recognition to detect cheating during an online final.

Application: Enables secure assessment in fully digital courses.

Challenges: Balancing security with student privacy and accessibility.

#### Research Ethics Board (REB)

Related terms: Institutional Review Board (IRB), consent, data protection.

Explanation: A committee that reviews research proposals to ensure ethical standards are met, especially regarding human participants.

Example: Obtaining approval before collecting clickstream data from learners.

Application: Safeguards participant rights and institutional compliance.

Challenges: Navigating lengthy approval processes and evolving data regulations.

#### Response Time Analysis

Related terms: latency measurement, cognitive load, interaction logging.

Explanation: Examining the interval between a learner's stimulus and their response to infer processing difficulty.

Example: Measuring longer response times on complex problem-solving items in a digital quiz.

Application: Identifies concepts that may require additional scaffolding.

Challenges: Requires precise timestamp synchronization and may be confounded by external distractions.

### Scalable Learning Analytics

Related terms: big data, cloud computing, real-time processing.

Explanation: Techniques that allow analytics to handle large volumes of learner data efficiently.

Example: Deploying a distributed processing pipeline to analyze millions of interaction events nightly.

Application: Supports institution-wide dashboards and early-warning systems.

Challenges: Infrastructure costs, data governance, and ensuring algorithmic fairness at scale.

### Self-Efficacy

Related terms: Bandura, confidence, motivation.

Explanation: An individual's belief in their capability to execute tasks and achieve goals.

Example: Learners with high self-efficacy persist longer on challenging coding exercises.

Application: Predictor of engagement and performance in technology-rich environments.

Challenges: Measuring accurately and distinguishing from related constructs like self-esteem.

### Sentiment Analysis

Related terms: natural language processing, affect detection, opinion mining.

Explanation: Computational technique that determines the emotional tone behind textual data.

Example: Analyzing forum posts to gauge student satisfaction with a new LMS feature.

Application: Provides rapid feedback on learner attitudes.

Challenges: Contextual nuance, sarcasm detection, and language diversity.

### Sequential Mixed Methods

Related terms: explanatory sequential, exploratory sequential, phased design.

Explanation: A mixed-methods approach where one data collection phase follows another, informing subsequent steps.

Example: Conducting a survey first, then using its results to design focus-group questions.

Application: Allows refinement of instruments based on preliminary findings.

Challenges: Extended timelines and need for flexible research planning.

### Simulation-Based Learning

Related terms: virtual labs, scenario-based training, immersive environments.

Explanation: Educational experiences that replicate real-world processes through interactive digital models.

Example: A virtual chemistry lab where students conduct experiments without hazardous materials.

Application: Provides safe, repeatable practice for complex skills.

Challenges: High development costs and ensuring fidelity to authentic tasks.

### Social Network Analysis (SNA)

Related terms: graph theory, centrality, community detection.

Explanation: A method for mapping and measuring relationships and flows between people, groups, or entities.

Example: Visualizing peer-to-peer communication patterns in an online discussion forum.

Application: Identifies influential learners and potential collaboration gaps.

Challenges: Data privacy, dynamic network changes, and interpretation of structural metrics.

### Software Usability Testing

Related terms: think-aloud protocol, task completion, error rate.

Explanation: Systematic evaluation of how easily users can learn and use a software product to achieve specific goals.

Example: Observing students as they navigate a new e-portfolio platform while verbalizing their thoughts.

Application: Informs iterative improvements to interface design.

Challenges: Recruiting representative participants and capturing authentic usage contexts.

### Standardized Assessment

Related terms: norm-referenced, criterion-referenced, psychometrics.

Explanation: An evaluation administered and scored in a consistent manner across different settings.

Example: A national computer-science proficiency test delivered online.

Application: Facilitates comparison of learner performance across institutions.

Challenges: Aligning test items with diverse curricula and ensuring cultural fairness.

### Statistical Power

Related terms: effect size, sample size, Type II error.

Explanation: The probability that a test will correctly reject a false null hypothesis, i.e., detect a true effect.

Example: A study with 80% power to detect a medium effect of a new gamified assignment.

Application: Guides sample size calculations for EdTech experiments.

Challenges: Balancing power with resource constraints and ethical considerations of participant recruitment.

### Student-Generated Content (SGC)

Related terms: peer teaching, crowdsourcing, collaborative authoring.

Explanation: Learning materials created by learners themselves, often shared within a community.

Example: Students produce tutorial videos on using a new data-visualization tool.

Application: Enhances deep learning and builds digital portfolios.

Challenges: Quality control and ensuring alignment with learning objectives.

### Survey Instrument Validation

Related terms: construct validity, reliability, pilot testing.

Explanation: The process of confirming that a questionnaire accurately measures the intended constructs and yields consistent results.

Example: Conducting a factor analysis to confirm that items load onto intended dimensions of digital competence.

Application: Increases confidence in data collected for EdTech research.

Challenges: Requires iterative refinement and sufficient respondent numbers.

### Technology Acceptance Model (TAM)

Related terms: perceived usefulness, perceived ease of use, behavioral intention.

**Explanation:** A theoretical framework that predicts user adoption of technology based on perceived benefits and effort.

**Example:** Using TAM to assess faculty willingness to adopt a new analytics dashboard.

**Application:** Guides change management strategies for EdTech deployment.

**Challenges:** May oversimplify complex motivational factors and cultural influences.

#### Thick Description

**Related terms:** contextualization, ethnography, interpretive analysis.

**Explanation:** Detailed narrative that situates observations within their broader social and cultural context.

**Example:** Providing a vivid account of how learners interact with an AR field-trip in a rural school.

**Application:** Enhances transferability of qualitative findings.

**Challenges:** Requires extensive fieldwork and narrative skill.

#### Time-Series Analysis

**Related terms:** autoregressive models, trend detection, seasonality.

**Explanation:** Statistical techniques for analyzing data points collected sequentially over time to identify patterns.

**Example:** Examining weekly login frequencies to detect seasonal dips in platform usage.

**Application:** Informs scheduling of interventions and resource planning.

**Challenges:** Requires consistent data collection intervals and handling of autocorrelation.

#### Transferability

**Related terms:** external validity, generalization, contextual relevance.

**Explanation:** The extent to which research findings can be applied to other settings, populations, or times.

**Example:** Assessing whether results from a pilot AI tutoring study in one university hold for community colleges.

**Application:** Supports scaling decisions for EdTech innovations.

**Challenges:** Differences in infrastructure, learner demographics, and institutional culture may limit applicability.

#### Triangulation

**Related terms:** methodological convergence, data source diversity, validation.

**Explanation:** The use of multiple methods or data sources to cross-verify findings and strengthen credibility.

**Example:** Combining clickstream analysis, survey responses, and interview data to evaluate a new LMS feature.

**Application:** Reduces bias and enhances robustness of conclusions.

**Challenges:** Requires careful coordination and synthesis of heterogeneous data.

#### Usability Heuristics

**Related terms:** Nielsen's ten heuristics, user experience, design principles.

**Explanation:** General rules of thumb for evaluating the ease of use and efficiency of an interface.

**Example:** Checking that error messages are clearly displayed and offer constructive solutions.

**Application:** Guides rapid assessment of educational software.

**Challenges:** Heuristics are generic and may need adaptation for specific learning contexts.

### Validity Threats

Related terms: construct drift, instrumentation, selection bias.

Explanation: Factors that can compromise the accuracy of inferences drawn from research data.

Example: Participants dropping out disproportionately from the control group, threatening internal validity.

Application: Informs rigorous study design and interpretation.

Challenges: Identifying and mitigating multiple concurrent threats.

### Video Analytics

Related terms: facial expression detection, gaze tracking, engagement metrics.

Explanation: The extraction of meaningful data from video recordings to assess learner behavior and affect.

Example: Measuring head nods as a proxy for comprehension during a recorded lecture.

Application: Provides real-time feedback to instructors on student engagement.

Challenges: Privacy concerns, processing overhead, and accuracy of affect detection algorithms.

### Virtual Reality (VR) Pedagogy

Related terms: immersive learning, presence, spatial cognition.

Explanation: Instructional strategies designed to leverage the unique affordances of VR environments for learning.

Example: A VR anatomy lab where students manipulate 3-D models of the human heart.

Application: Enhances spatial reasoning and experiential learning.

Challenges: High hardware costs, motion sickness, and designing curriculum-aligned experiences.

### Weighted Least Squares (WLS)

Related terms: regression analysis, heteroscedasticity, estimation technique.

Explanation: A regression method that assigns different weights to observations to account for varying variance.

Example: Applying WLS to model student scores where variance differs across proficiency levels.

Application: Improves model accuracy when assumptions of ordinary least squares are violated.

Challenges: Determining appropriate weights and ensuring model stability.

### Wikis as Learning Platforms

Related terms: collaborative authoring, knowledge construction, community of practice.

Explanation: Online environments that allow multiple users to create, edit, and organize content collectively.

Example: A course-wide wiki where students co-author summaries of research articles.

Application: Fosters collective knowledge building and digital literacy.

Challenges: Monitoring content quality and managing edit conflicts.

### Zero-Inflated Models

Related terms: count data, overdispersion, hurdle model.

Explanation: Statistical models that account for excess zeros in count data by modeling the zero-generating process separately.

Example: Modeling the number of times students access a supplemental resource, where many never access it.

Application: Provides more accurate estimates of usage patterns in EdTech adoption studies.

Challenges: Model complexity and interpretation of dual processes.