Glossary[1]

21st century skills Those skills believed necessary to contribute to workforce production and maintenance of a high quality of life in the twenty-first century, including skills related to creativity, collaboration, communication, critical thinking, information literacy, media literacy, and technology literacy.

Academic emotions Affective experiences in relation to academic activities or the outcomes of the activities.

Action research Research conducted by practitioners that follow a cyclical process including posing a question, collecting data, reporting findings and, based on those findings, posing new research questions; may be used interchangeably with "teacher research" or "practitioner research."

Activity theory A theoretical framework which takes the collective activity involving agents, objects, goals, and resources as a composite unit of analysis.

Actor network theory An approach to investigate socio-technical network building process.

Adaptive system A computer-based system or learning environment that provides personalized learning materials, either instruction, content, or support and feedback.

ADDIE An acronym which stands for Analysis, Design, Development, Implementation, and Evaluation; the origins of the term are uncertain and it is common to other disciplines; it may be a mnemonic device for the stages of system engineering as they are applied to instructional design.

Affective states Typically, affective states is used as a collective term for emotions, feelings, moods, and attitudinal states.

Affordances The tasks or activities made possible by specific features or functions of technologies.

AKOVIA Automated knowledge visualization and assessment—a Web-based tool to support learning and assessment.

Alignment A term developed in relation to communities of practice, denoting the process through which one community is influenced by another and then modifies their activities; it is also used to refer to the consistency and coherence between goals, objectives, activities, and assessments.

Alternative assessment Any assessment method that is an alternative to simple fact-based tests; examples include portfolios, problem conceptualizations, and concepts maps; alternative assessments are typically linked directly to a specific unit of instruction or curriculum module and may be customized for specific students.

Analogical reasoning A kind of nondeductive and naturalistic reasoning in which what is known about one exemplar is used to infer new information about another exemplar.

Applied research Research aimed at providing solutions to practical problems or producing findings useful in professional practice, unlike basic research which generally seeks to find fundamental causes for a variety of phenomena.

Artificial Intelligence (AI) A branch of computer/cognitive science that aims to simulate or embed human intelligence in information-processing devices.

Artificial Intelligence in Education (AIED) A highly interdisciplinary research field based on computer science, education, and psychology, applying AI techniques to the design of learning environments.

Assessment The measurement of performance, learning, skills, artifacts, portfolios, or products; evaluation of individual knowledge, skills, and attitudes; a process to determine the state of an individual's knowledge, skills, and attitudes.

[1] This glossary represents a synthesis of the keyword definitions provided by contributors to the *Handbook*. Some of these definitions have been altered slightly for consistent form, and others have been combined to provide readers with a useful synthesis. One should bear in mind that these terms have been defined by the authors from the perspective of their particular chapters and for the purposes of this *Handbook*. For a more comprehensive definition of the field and its domains, readers are encouraged to consult: Januszewski, A., & Molenda, M. (Eds.). (2008). *Educational technology: A definition with commentary*. New York: Routledge.

J.M. Spector et al. (eds.), *Handbook of Research on Educational Communications and Technology*,
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Assessment methods Methods for assessing the quality or completeness of knowledge acquisition and performance.

Assessment standards Specifications that provide evidence for the quality of the three primary aspects of evaluation: validity, objectivity, and reliability.

Augmented reality Technologies that present on a digital device an interactive narrative, navigation means for learners, and/or academic information all of which are superimposed on (a representation of) a physical location or device.

Authentic assessment Assessment of learning through the evaluation of meaningful products and performances under natural rather than artificial (e.g., examination) conditions; the tasks are either replicas of or analogous to those actually encountered in practice.

Authentic learning environments Pedagogical conditions in educational contexts that provide opportunities for students to collaboratively undertake challenging and realistic tasks resulting in meaningful products and significant learning.

Automatic scoring Software-based techniques that produce instantaneous measures of the performances of a person on a test, an essay, an e-portfolio, or any other source of evidence based on academic or professional assessment standards.

Behaviorism The perspective that learning is the association of stimuli and responses through rewards and punishments with little or no emphasis on cognitive processes; the view that the most important factor influencing learning is reinforcement; behaviorism is often investigated using experimental research designs.

Benefits of educational technology The monetary or monetized value of the effects of educational technology interventions; more generally, the affordances made possible by educational technologies.

CAQDAS Computer-Assisted Qualitative Data Analysis as coined by Fielding and Lee in the 1990s; some writers refer to it as Computer-Assisted Qualitative Data Analysis Software; it is an alternative term to QDAS for software tools that support the analysis of qualitative data.

Case study Qualitative or mixed methods research providing in-depth inquiry of a bounded social system or complex situation (the case).

Case-based approach Uses a real or realistic story to situate a problem or a dilemma as a basis for learner inquiry, discussion, investigation, and solution development.

Case-based learning system Consists of four essential elements: instructional purposes, learning and teaching, assessment and evaluation, and learning outcomes for both short-term results and long-term impact.

Causal attribution Retrospective appraisal of the relation of observed effects and likely causes.

Causal expectancies Prospective appraisal of the relation of causes to anticipated effects.

Change agent A person or event primarily responsible for initiating and guiding an organization, system, group, or individuals to make changes that are sustainable, feasible, and effective for a given system.

Change management The process by which change is guided, influenced, and communicated within an organization or system.

Civics education Includes the knowledge, skills, and dispositions required for active and responsible participation in society.

Cognitive abilities Abilities to perform such functions as perceiving, reasoning, and judging which are generally associated with knowing and understanding.

Cognitive appraisal A subjective evaluation of situations, competences, activities, and outcomes.

Cognitive demands Mental processing requirements associated with a given learning task; cognitive load theory distinguishes intrinsic load inherent in a task, extraneous load associated with factors surrounding the task, and germane load pertinent to successful performance of the task.

Cognitive processes Processes such as attention, retrieval, and metacognition that control learning and retention.

Cognitive resource theory A cognitive–psychological research theory that emphasizes the limitations of working memory capacity.

Cognitive task analysis An analysis process using structured interviews and other strategies to identify the implicit and often nonconscious mental processes and decisions that experts use to achieve a goal and/or solve a complex problem.

Cognitive tool Cognitive tools are those learning resources intended to help learners construct new knowledge by such means as dynamic representations and context-sensitive interactions; cognitive tools are typically computer-based tools that can extend thinking processes such as problem solving and creativity and in doing so support the learning process.

Collaboration script An explicit description or an internal resource that helps individuals participate successfully in a group learning activity; typically it focuses on some combination of role definitions and guidance about the sequence of activities to be undertaken.

Collaborative learning A situation in which two or more people learn or attempt to learn something together using their combined knowledge and abilities to solve a problem or construct a response.

Colocated collaborative learning Pedagogy that emphasizes the criticality of social interaction synchronously coordinated among learners who are in the same physical location.

Communities of practice Used in an account of the social processes of learning that focuses on participation in stable communities over time.

Competency A related set of knowledge, skills, abilities, dispositions, and other personal attributes, relevant to a task or targeted learning outcome.

Computational modeling The process of studying the behavior of a system using computer simulations and mathematical models.

Computer-supported collaborative learning (CSCL) Refers to a situation in which computer technology plays a significant role in the way in which students work together to maximize their own and each other's learning.

Computer-based scaffolding Support delivered by a computer that allows learners to meaningfully participate in and gain skill at a task that they could not complete unaided; see also instructional scaffolding and scaffolding.

Conative domain Theorized part of the mind, in addition to cognitive and affective, that drives individual will, intent, and ethics.

Conceptual age learning Learning in a knowledge society that is flexible, accessible, immediate, interactive, and focused on collaboration.

Confirmatory evaluation A structured or systematic process to determine the extent to which the assumptions and problems that led to a project or program are still applicable.

Connected teaching Instruction using information and communications technology and informed by policy and research in educational technology.

Constructivist epistemology A naturalistic approach to the theory of knowledge that focuses on describing how people actually develop knowledge and beliefs; an essential aspect of a constructivist epistemology is the notion that individuals construct internal representations in response to various situations as a natural process of interpreting their experiences.

Constructivist principle of learning The notion that the learner is active in coproducing knowledge, rather than a passive recipient of that knowledge.

Context Information that characterizes an object, person, place, or other aspects of a situation; situational factors that influence understanding and meaning making.

Context-aware The capability to leverage mobile sensors and locative technologies to filter and present information to the user on a mobile devices relevant to a physical position.

Context modeling The process of building and frequently updating context information in a context model.

Conversational agent A type of pedagogical agent programmed to interact with learners in open-ended conversations.

Cooperative inquiry A mode of inquiry for action research involving the participant in self-study in groups commonly employing qualitative or mixed methods to understand meaning and outcomes focused on practice.

Cost–effectiveness analysis Analysis that assesses and compares the costs and effects or effectiveness of competing projects or alternative solutions.

Costs of educational technology The value of both direct and indirect resources required to plan and implement educational technology interventions.

Critical mathematics education Mathematics education emphasizing the challenges emerging from the critical nature of mathematics education (especially those concerning equity and social justice).

Cultural–historical theory A research paradigm assuming that development results from the interplay between the individual mind and society; the most important factor influencing learning is social interaction with the world and with others.

Culture All that is man-made, including adaptations to nature; the evolved human capacity to classify and represent experiences with symbols, and to act imaginatively and creatively; the distinct ways that people living in different parts of the world classify and represent their experiences, and act creatively.

Culture-specific Specialized or localized to a target audience.

Data acquisition The process of recording measures of physical or psychological conditions and converting the resulting measures into values that can be manipulated and analyzed.

Data analysis The process of inspecting, cleaning, transforming, and modeling trends or patterns in data in order to highlight useful information, draw conclusions, and support decision making.

Data visualization Graphical representation of data sets or analysis results for the purpose of illustrating relationships among variables and/or subjects in the data.

Data-based decision making Using results to inform pedagogical and programmatic decisions.

Data-driven decision making Similar to data-based decision making with emphasis on creating motivation for action.

Decision making Selecting between two or more alternatives using criteria that are useful to determine which alternative is the best for the conditions in a given situation; the cognitive processes involved in the selection of a course of action among several alternatives.

Design All the activities involved in generating intentional change (e.g., learning or performance) via artifacts and experiences; the activity of creating a plan that can be executed to produce an artifact or an event.

Design and development research The systematic study of design, development, and evaluation processes with the aim of establishing an empirical basis for the creation of instructional and noninstructional products and tools and new or enhanced models that govern their development.

Design and development tools Devices, often computer-based, that support the efficiency and yield of instructional designers and developers.

Design experiments Design research or a specific subset of design research wherein design features of a treatment (e.g., learning program, educational resource, teaching approach) are systematically varied to identify those features with comparatively powerful or weak effects.

Design knowledge Specialized forms of knowledge required to carry out design activities; design knowledge is distinct from scientific knowledge and includes both tacit and explicit declarative and procedural knowledge.

Design model An abstract description of how design can be carried out; a pattern for describing, prescribing, and realizing a way of viewing an act, object, artifact, or product.

Design pattern Captures and shares design experience in a structured text which states the essence of a solution, links it to the contexts in which the solution is applicable, and provides a rationale that connects solution, problem, and context.

Design research Research that is committed to developing theoretical insights and practical solutions simultaneously in real-world (as opposed to laboratory) contexts; it is most often conducted through long-term collaboration among researchers, practitioners, and other stakeholders.

Design science The scholarly research aimed at the explanation and prescription of the design process.

Design-based research See design research.

Desktop manufacturing A digital manufacturing system that is small enough to fit on a desktop and affordable enough for personal use, including personal digital fabrication systems and related technologies such as 3D printers and scanners.

Developmental psychology A subdiscipline of psychology that assumes cognitive processes change in a qualitative fashion as a function of development; an important factor influencing learning is the stage of cognitive development of the learner.

Digital fabrication Translation of a digital design into a physical object through manufacturing technologies such as computer-controlled die cutters and milling machines, 3D printers, and automated assembly systems.

Digital literacy The knowledge and abilities needed to search, locate, organize, analyze, evaluate, and synthesize information to communicate, manage, produce, and perform other tasks involving digital information and technologies.

Digital texts Publications that users can read online or on an e–book device. See also e-books.

Discourse analysis Research method focusing on the use of language through the close study of words, text, speech, or written documents, including understanding of themes, meaning, semiotics, or interaction patterns.

Economic development Increased output or productivity of an economy or policies or structures put in place to promote such development.

Education reform Policies and programs intended to make significant changes in an educational system resulting in significant improvements in learning and performance.

Educational data mining (EDM) A highly interdisciplinary research field based on psychology, education, computer science, and statistics, with a focus on analyzing data that come from the tracking of learner behavior in electronic learning environments; see also learner analytics.

Educational innovation Application of new educational models, methods, and/or resources affecting the traditional relationships between learning systems, teachers, and students.

Educational modeling The process of building learning scenarios using a modeling language, technique, or technology.

Educational psychology The study of theory and practice related to the psychology of teaching, learning, and behavior in educational and training settings.

Educational technology The study and practice of supporting learning and performance by creating, using, and managing appropriate technological processes and resources; any tool, equipment, or device that helps accomplish learning goals; educational technology includes both instructional and learning technologies; the disciplined application of scientific principles and theoretical knowledge to support and enhance human learning and performance; the study and use of technological resources and devices for teaching and learning; see also Januszewksi & Molenda (2008).

Educational technology policy Mandates for schools to utilize educational technologies in classrooms based on the belief that (1) technology can improve instruction and facilitate learning, and (2) students need to develop technology literacy and skills in order to become productive members of society in a competitive global economy.

Educational technology research The study of the impact and effects of using technology to facilitate and enhance learning and performance.

EEG Electroencephalography, which is a neuroimaging technique that involves the recording of voltage fluctuations resulting from ionic current flows within the neurons of the brain.

Efficiency Producing the most of a desired outcome at a given cost, or producing a given desired outcome at the lowest possible cost.

e–book A publication in a digital format that users can read with an electronic device such as an e-book reader, a tablet device, a computer, or a phone; e-book sometimes also refers to the devices on which people read digital publications.

e-learning Learning that happens through an electronic form or is supported with digital devices.

e-learning standards A set of specifications for the design of the components of a learning system.

Electronic books See e-books.

Emotion regulation Processes by which individuals make changes in themselves and their environments in order to influence their emotions.

Epistemology The branch of philosophy focused on examining the nature, methods, limitations, and validity of knowledge.

ERP Event-related potential, which is an electrophysiological response to a sensory, cognitive, or motor stimulus that is measured using electroencephalography.

Essential processing Essential processing is the learner's cognitive processing during learning that is needed to mentally represent the presented material; essential processing includes selecting relevant information and organizing it as presented.

Ethics across the curriculum Teaching and integration of ethics across all disciplines in a formal context.

Ethics as design Use of a design process to address moral or ethical constraints.

Ethnography In depth, holistic inquiry into a human social group typically delineated by a common culture using methods of interview, observation, and artifact analysis undertaken in a naturalistic setting to produce a rich or thick description as its end product.

Evaluation Assessing whether learning occurred and/or learning and other objectives have been achieved for a group of learners associated with a course or program; determination or judgement of the value, worth, or quality of a program, project, or set of activities.

Evidence-based policy A policy model in which research evidence is synthesized through systematic processes of aggregation, typically favoring the integration of randomized control trials.

Evidence-based practice Adopting evidence as the foundation for educator practice.

Evidence-centered design (ECD) A framework that provides design principles to build and implement educational assessments as coherent evidentiary arguments.

Experimental design A type of study which uses random selection and assignment of participants to a treatment or control group; this should result in groups that are statistically equivalent on both observable and unobservable characteristics thereby allowing causal inference and attribution.

Expertise Skill and knowledge gained over time by consistently solving problems of increasing complexity and achieving goals in an environment with stable regularities.

External validity Stimulus materials that are realistic in either content or design that relate to real-life applications.

Extraneous processing In cognitive load theory, the learner's cognitive processing during learning that does not support the instructional goal; a kind of undesirable cognitive load; see cognitive demands.

Feedback Information about actual performance in relation to the intended goal for the purpose of improving learning or performance.

Fidelity The extent to which implementation matches the intended program model.

Flexible learning environments A learning environment in which learners are able to follow and design their own learning trajectories given the formal learning goals.

fMRI Functional magnetic resonance imaging, which is a neuroimaging technique that uses the change in magnetization between oxygen-rich and oxygen-poor cerebral blood as its basic measure of brain activity.

fNIRS Functional near-infrared spectroscopy, an optical neuroimaging technique that images brain activity by detecting changes in cerebral blood flow using a near-infrared light sensor.

Formative assessment A constant adjustment process used by both teachers and students to improve teaching and learning using information gathered from formal and informal assessments.

Formative evaluation A structured or systematic process to continuously monitor the progress of a project or program to help ensure its success in achieving intended outcomes; sometimes referred to as process evaluation; the basis for a fidelity of implementation study; the iterative collection and feedback of process data to support program development and improvement.

Formative research Often a synonym for design research; may also refer to the formative testing and subsequent refinement of any treatment (e.g., learning programs, educational resources, or teaching approaches).

Front-end analysis A systematic approach to analyzing the specific knowledge, skills, motivation, prior experience, and tools required to perform a job or set of tasks in advance of designing training or performance improvement interventions.

Generational differences The theory that people born within an approximately 20-year time period share a common set of characteristics based upon the historical experiences, economic and social conditions, technological advances, and other societal changes they have in common.

Generative processing The learner's deep cognitive processing during learning aimed at making sense of the presented material; it includes mentally reorganizing information and integrating it with relevant prior knowledge activated from long-term memory.

Gestalt psychology An approach in psychology that assumes the human mind is operating in a holistic fashion

with self-organizing tendencies; the most important factor influencing learning is reaching insight and understanding through restructuring.

Grounded theory A formal and rigorous process of collecting and analyzing qualitative data using an inductive approach to generate commonalities with methodological variations including social, interpretive, and critical grounded theory.

HIMATT Highly Integrated Model Assessment Technology and Tools; a set of related and interoperable Web-based tools to analyze concept maps and text that can be represented in the form of a concept map in order to determine progress of learning in complex, problem-solving domains.

Historical inquiry Constructing historical interpretations after exploring, questioning, scrutinizing, and analyzing multiple sources.

Human performance technology (HPT) The study and practice of improving productivity and performance in an organization by planning and implementing interventions that are results-oriented, comprehensive, systemic, the effectiveness of which can be measured.

ICT (information and communications technologies) competencies Abilities that involve basic and general-purpose applications of information and communication technologies in the home, office, or school.

ICT impact The documented influence of information and communication technologies on any of a range of potential outcomes, such as teaching practice or student learning.

ICT literacy assessment Diagnosis and evaluation of ICT competencies, from management, storing, navigation, and communication of information to creatively produce new information and the use of digital or electronic devices and telecommunications.

ICT policy Governmental policies and programs related to the implementation and use of information and communication technologies.

Ill-structured tasks Tasks with ill-defined learning goals, with multiple solutions or solution paths, and/or with partially defined initial, transition, or goal states.

Immersive technologies Technologies that create the impression that one is participating in a realistic experience via the use of sensory stimuli, narrative, and symbolism.

Individual and group differences Those preferences, traits, and learned behaviors that define and differentiate each learner, educator, and cohort from their peers in the ways they understand themselves, how they learn, interact, and respond to information and contextualize it.

Informal learning Learning activities that typically take place in out-of-school settings, including activities that comprise after-school programs or those in youth and community organizations, including museums, botanical gardens, and zoos; informal learning may also include self-instructional activities.

Informal science education Science learning experiences, programs, or activities take place outside the classroom in such settings as museums, science centers, and media outlets.

Information processing theory A research theory that assumes the human mind is an information-processing device with different components; the most important factor influencing learning is the active mental processing of information.

Information visualization The use of computer-supported, interactive, visual representations of abstract data or objects to amplify cognition and improve comprehension.

Innovative technologies New or emerging products or technologies that enable new methods of communication or interaction with resources that affects learning and instruction.

Inquiry learning An approach to learning that involves a process of exploring the natural or material world, and that leads to asking questions, formulating hypotheses, testing hypotheses, explaining findings, and generating alternative possibilities in the search for new or deeper understanding.

Instruction Any activity that supports learning and informs teaching; a conversational form that has the potential for leading to learning.

Instructional communications system A communications system made up of interrelated parts that depend on each other for input and output, working together toward the common goal of facilitating learning.

Instructional design (ID) A methodology for analyzing, designing, producing, evaluating, delivering, and testing a learning system; the systematic process and design science involved in creating instructional activities and learning environments that facilitate engagement in the learning process; the activity of creating a plan for an instructional conversation which can be executed through live and/or technology-based means to supply the potential for learning; a purposeful activity that results in strategies, activities, and resources which facilitate or enhance learning; see also Januszewksi & Molenda (2008).

Instructional design model An abstract description, usually at a high level of generality, of how instruction can be designed; a graphic or verbal representations of organized procedures for planning and implementing instructional materials, materials and programs.

Instructional designer A person who has or is acquiring the competencies to design instruction; see also http://www.ibstpi.org.

Instructional development The execution of a design to produce through live and/or technology-based means

conversational occasions and/or other resources to promote learning.

Instructional engineering A methodology based on software and knowledge engineering principles, applied to instructional design.

Instructional message design The specification and manipulation of media for the purpose of supporting learning.

Instructional products Planned solutions that facilitate a change in learning (e.g., a digital educational game) or performance (e.g., an electronic performance support system).

Instructional scaffolding Support provided by a teacher/parent, peer, or a computer- or paper-based tool that allows students to meaningfully participate in and gain skill at tasks that they could not complete unassisted; see also computer-based scaffolding and scaffolding.

Instructional strategies Methods or approaches to support learning.

Instructional systems design (ISD) A structured process for the design, development, implementation, and evaluation of learning to improve performance and ensure the quality of instruction with primary roots in adult education; an abstract concept that refers to a variety of instructional design models often connected with or based on the concepts of systems engineering and systems engineering methods; see also instructional design, instructional development, and instructional engineering.

Instructional technology Educational technologies teachers and others employ to support learning; see also see also Januszewksi & Molenda (2008).

Intelligent tutoring system (ITS) A system designed to tutor learners and that can adapt based on learner variables such as performance and preferences.

Interactive spaces A generic category meant to capture environments that intend to connect disparate devices through networking protocols and may include sensor and recording technologies.

Interactive surfaces A generic category meant to capture a range of devices including smartphones, tablets, and tabletops.

Internal validity In a research context, that which is designed to eliminate sources of extraneous variance from the environment that could confound results.

Interpretive tradition Qualitative research with an emphasis on individual perception and interpretation of experience, often from the participant's point of view; includes narrative, auto-ethnographic, and phenomenological approaches.

Kinesthetic learning Learning that is grounded in movement, gesture, posture to enhance cognitive and affective components.

Knowledge diagnosis A systematic assessment of structures of declarative knowledge and procedural knowledge by means of specific measurements.

Knowledge-based design The structure of a learning system resulting from a knowledge engineering activity.

Learner agency The empowerment of the learner as an active entity capable of self-regulation.

Learner modeling The process in which cognitive, affective, and behavioral characteristics of individual learners are measured and incorporated in a model, with the aim to personalize learning for the individual; also called user modeling (UM) or student modeling.

Learning The outcome of acquiring knowledge or information; the process of constructing knowledge and skills; a relatively stable change in what a person knows or can do.

Learning ability The ability develop knowledge and acquire expertise and/or to direct and regulate one's own learning.

Learning analytics The measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs.

Learning design The application of design knowledge while developing a concrete unit of instruction, such as a course, a lesson, a curriculum, or a learning activity.

Learning environment An instructional system that offers a task environment with learning resources and that provides support to help students develop the knowledge and skills involved in that task.

Learning opportunity Instructional interventions or situations aimed at providing learners an opportunity to develop knowledge and skills.

Learning styles a general description of the attitudes, behaviors, and preferences that influence how an individual may best learn various things.

Learning technology Educational technologies learners use to accomplish specific learning objectives and tasks.

Learning theories Learning theories reflect the outcomes of research on learning that have developed over time with changing paradigms; they provide a conceptual framework and sets of key variables likely to influence learning.

Learning through collaboration A learning process in which two or more people communicate, share resources, and/or negotiate meanings to achieve their shared learning goals.

Lesson planning Processes for designing classroom instruction, commonly used by teachers in primary and secondary schools and applied within a curriculum framework.

Location-based method The capability to leverage GPS, compass, and gyroscope technologies to present environment-specific digital media to learners as they move through a physical area with a smartphone or similar mobile device.

Logic model A representation of the (a) assumptions and problems leading to a project or program, (b) the input

factors and variables that affect the situation and that may or may not be affected by the planned intervention, (c) the immediate outputs of interim and enabling developments of the project or program, and (d) the short-term and longer-term outcomes of the project or program; a visual depiction of the theory of change associated with a project or program.

Mathematics education The practice of teaching and learning mathematics, along with the associated scholarly research.

Media arts An art form making use of electronic technologies such as computer graphics, animation, interactive art, robotics, and virtual environments.

Medical education The institutions and processes (formal and informal) involved in preparing medical students entering the medical profession as physicians and the processes of maintaining professional development opportunities for practicing physicians.

Medical school reform Large-scale efforts to update and enhance overall medical school curriculum.

Mental model A mental representation that people use to organize their experience about themselves, others, the environment, and the things with which they interact; its functional role is to provide predictive and explanatory power for understanding these phenomena.

Mental representation A theoretical construct to explain ongoing information processing in the human brain.

Message Ordered sets of perceptual elements or cues drawn from a particular pool and assembled in a deliberate way for the purpose of modifying psychomotor, cognitive, or affective behavior.

Metacognition The knowledge of and ability to monitor one's own cognitive processes while formulating and modifying plans, assessing progress, and reevaluating goals.

Millennials People born in or after 1982 (approximately) who are members of the first generation who were born after the advent of digital media and who have grown up with these media; also called digital natives.

Mobile learning Learning that leverages the portability and connectivity of a smartphone, tablet, or other device that can be held without strain in one hand and moved from one location to another.

Model A mental or physical construct of a referent; the referent of a model may be a natural or artificial object, process, or phenomenon.

Model-based reasoning Model-based reasoning is the process of analyzing the natural world and making inferences through using, building, evaluating, and refining models; an instructional strategy which involves students working with models; it often refers to the theory of mental models.

Motivation to learn Desire and willingness to initiate and continue learning-related activities.

Multicultural Relating to or including several cultures.

Multicultural learning The respect for and support of multiple cultures within an instructional setting or learning environment incorporating instructional materials presented in a manner that supports their existing cultural interpretations so as to maximize the effective learning potential and foster respect for diversity.

Multimedia learning Learning supported with multiple media (e.g., text, pictures, and video).

Multiuser virtual environment Digital systems allowing many online users to build digital spaces, manipulate avatars, and interact with other online users and the virtual environment.

Natural user interface A system in which the user manipulates a digital application using hands, gestures, or spoken language.

Needs assessment A structured or systematic process to determine the nature of a problematic situation as an initial step in elaborating alternative solution approaches.

Networked learning Learning in which information and communication technology is used to promote connections between and among learners, between learners and tutors, or between a learning community and various resources.

Neuroimaging The use of direct or indirect methods to image the structure and function of the brain.

Neuroscience The study of the nervous system that advances our understanding of human emotion, cognition, and behavior.

Non-scaffolding instructional support A category that includes other tools (e.g., job aids) that help students accomplish tasks.

One-to-one scaffolding Dynamic support provided by one teacher/parent to one student that allows the latter to meaningfully participate in and gain skill at a task that he/she could not complete unaided.

Open educational resources Educational materials either in the public domain or licensed under an open license such as Creative Commons.

Open learning environments Learning settings where the individual engages learning activities with minimal external direction (see self-directed learning).

Organizational change The dynamic shifts in the complex and multifaceted practices, beliefs, and structures within an organization from one state of being to a different state as a result of planned or unplanned agents of change.

Participatory action research A specific genre of action research that differs from classroom-based action research in that emphasis is on addressing critical social issues that extend beyond the classroom.

Pathfinder A system for deriving and representing the organization of knowledge structure.

Pedagogical agent Anthropomorphous virtual characters employed in online learning environments to serve various instructional goals.

Peer scaffolding A type of one-to-one support that is provided by a peer rather than a teacher/parent and guided by a scaffolding framework that allows students to meaningfully participate in and gain skill at a task that they could not complete unaided.

Performance appraisal The procuring, analyzing, and documenting of facts and information about an employee's net worth to the organization with the goal of measuring and constantly improving the employee's present performance and tapping the future potential.

Performance evaluation Prepared by an organization on a periodic basis to determine if employees are working up to, or beyond, the minimum standards of their job descriptions.

Performance task A performance task is a goal-directed assessment exercise consisting of an activity or assignment that is completed by the student and then judged by the teacher or other evaluator on the basis of specific performance criteria.

Performance-based training A special application that closes gaps between actual and desired human performance in organizations that arise owing to a lack of skill and knowledge.

Personalized instruction Instruction that has been modified or adapted in some way, either manually by the teacher or automatically using adaptive technologies, to meet the individual needs of a learner based on information obtained about that individual student.

Personalized learning The method by which learners are offered tailored instruction and support, personalized to the individual needs, goals, or behavior of learners.

Phenomenology A philosophical discipline aimed at understanding lived individual experiences or life worlds; a naturalistic approach to epistemology.

Philosophy of science The study of how scientific knowledge develops over time and across a variety of disciplines with emphasis on evidence, knowledge production, and the formation of theories to explain observed phenomena.

Policy sociology An account of the process of policy formation and implementation that focuses on actors and their actions, rather than exclusively on the policy texts that are produced.

Portfolio assessment Structured examinations of collected samples of student work.

Post-positivist science A model of scientific inquiry that emphasizes the notions of falsification and establishment of causal relationships to develop meaningful interpretations of phenomena.

Precedent With regard to design knowledge, a precedent is the experience (immediate or vicarious) one designer obtains of the work of another and/or any life experience that affords the basis for design moves/decisions.

Preservice teachers Candidates for primary or secondary teaching positions enrolled in an initial teacher education program en route to becoming classroom practitioners.

Prior knowledge Existing learner knowledge that influences which to-be-learned knowledge is selected and how it is organized and integrated.

Problem solving The process of articulating and solving problems in which a person has to change a starting situation into a desired end situation with through various operations and transformations; a mental process that involves discovering, analyzing, and solving tasks.

Problem types External factors defining problems create categories of problem types based on structuredness, complexity, and context.

Problem-based learning An instructional approach in which students construct knowledge and develop expertise as they solve problems representative of actual problems in a professional discipline.

Professional development The acquisition of the skills, knowledge, and expertise and other characteristics of a profession such as teaching; the training of teachers who are already teaching students in schools.

Professional ethics A set of standards and/or codes of conduct intended to guide the behavior and practice of the members of a given profession.

Program evaluation A structured or systematic process to determine how well a project or program is being implemented (fidelity of implementation) and to what extent the project or program is achieving its intended aims (impact); the systematic determination of a program's quality, utility, and/or effectiveness for use to make decisions and guide action.

QDA Qualitative Data Analysis; the range of processes and procedures whereby a researcher moves from the qualitative data that have been collected to some form of explanation, understanding, or interpretation.

QDAS Qualitative data analysis software; software tools that support the analysis of qualitative data.

Qualitative research Systematic and rigorous investigation of human behavior or phenomena commonly undertaken in naturalistic settings that emphasize words, meanings, beliefs, and symbols rather than numeric (statistical) patterning.

Qualitative research methods Methods of social research based principally on theoretical principles of interpretivism as expressed in approaches such as symbolic interactionism, hermeneutics, and ethnomethodology.

Quantitative tools Statistical analysis techniques designed to help discover trends and derive inferences regarding associations among variables in a data set.

Quasi-experimental design A design that results in intervention and comparison groups demonstrating baseline equivalence on observed characteristics through a process other than random assignment.

Realistic mathematics education A view that mathematics education should give students guided opportunities to reinvent or discover mathematics by doing mathematics.

Real-world problemsolving Goal-oriented activities to reduce unknowns and solve a problem that actually exists or easily could exist; the process includes representing situations, defining goals, generating possible strategies, executing selected strategies, and reflecting on the effects.

Representation A depiction of an object or system visually, mathematically, and/or with text.

Research Using a systematic process to test a hypothesis or study phenomena.

Research funding Monetary (and in-kind) support for research.

Research methods Procedures and analytic techniques used to empirically establish the validity of claims.

Research paradigm Set of practices (what is studied, kind of research questions posed, how and with what tools studies are conducted, how results are analyzed and interpreted, etc.) defining a scientific discipline or subdiscipline; example research paradigms include positivist, interpretivist, critical, and post-structural approaches.

Research quality Formal process for evaluating systematic research studies examining design, methods, analysis, and assumptions for validity and credibility.

Rubrics Scoring guide for assessing performance based on the articulated performances related to performance criteria.

Scaffolding Guidance to support students in identifying goals, self-checking, navigating, assessing progress, understanding, and refining goals and strategies.

Scaffolding The process by which a teacher, a more knowledgeable peer, or tools within the learning environment assists a student at appropriate times appropriate in solving problems or accomplishing tasks that would otherwise be out of reach; see also computer-based scaffolding and instructional scaffolding.

Science of learning The scientific study of how people learn.

Scientific inquiry The disciplined investigation of phenomena with emphasis on understanding natural and social phenomena, seeking evidence, and explaining unusual events.

Scientific reasoning The ability to apply the scientific inquiry skills of hypothesis generation, experimentation and/or observation, and evidence evaluation in reasoning or problem-solving situations.

Self-directed learning Ability to formulate one's own learning needs, determine goals, initiate learning tasks, and assume responsibility for decisions associated with one's own learning.

Self-regulated learning Ability to monitor and steer one's own learning processes; see self-directed learning.

Self-regulation An active process characterized by learners setting goals for their learning and attempting to monitor and regulate their knowledge and behavior.

Serious games Computer or video games intended to support specific learning outcomes.

Simulation Imitating the behavior of a real-world process or system by simplifying and depicting the operation of critical elements and interactions over time using symbolic representations intended to help someone learn about the process; a technological environment that simplifies or enhances reality while retaining the fundamental validity of what is to be experienced or learned.

Situated cognition An approach that stresses that the context in which something is to be learned affects what is learned; more specifically, an approach that proposes that learning takes place as people solve problems and accomplish tasks within the social and physical contexts where the learning is actually applied.

Situated learning Assumes that knowing is inseparable from doing, and all knowledge is situated in activities bound to physical, social, and cultural contexts; learning should be presented in authentic contexts where learners would actively understand and use their learning.

Situation awareness Is the perception of current environmental elements with regard to their dynamic changes and the comprehension of their meaning.

Smart toy Play materials including tangible objects alongside electronic components that facilitate two-way child/smart toy interaction to carry out a purposeful task.

Social constructivism Emphasizes social interaction and collaboration among learners as essential components in the process of learning and teaching; as members of a learning community, learners become involved in common activities that embody certain beliefs and behaviors these learners need to acquire.

Social constructivist theory A research theory that combines perspectives from developmental psychology and cultural-historical theory; the most important factor influencing learning is the construction of meaning and knowledge through the interaction with others.

Social responsibility Systematic planning or design emphasizing outcomes at the societal level.

Stealth assessment A nonintrusive, evidence-based approach to assessment that is woven directly into learning environments to gather ongoing performance data and yield valid inferences about competency states.

STEM The fields of Science, Technology, Engineering and Mathematics; a new variant called STEAM includes the arts.

Stimulus materials Materials, often instructional in nature, that are designed to present a message in a systematic manner of which the resulting effect can be observed and/or measured.

Student modeling A process whereby information about students is stored, including domain competence and individual domain-independent characteristics; the process of building and updating the student model.

Student-centered learning A pedagogical approach in which students have primary responsibility for determining learning goals and/or the means to reach these goals.

Studio pedagogy A pedagogical pattern found in multiple fields of design study that includes consistent elements including group work space, public critique, hands-on practice as the primary activity of students, and support for problem solving as a primary activity of instructors.

Summative assessment A structured or systematic process to determine the extent to which an individual has achieved or is achieving the intended aims of instruction.

Summative evaluation A structured or systematic process to determine the extent to which a project or program has achieved or is achieving its intended aims.

Support device usage The use of support devices by learners, expressed in quantitative and qualitative variables.

Support devices Devices aiming to support learners in executing a learning task.

Symbolic cognitive theory A cognitive-psychological research theory that assumes meaning is conveyed in cognitive schemas and rules; the most important factor influencing learning is what the learner already knows.

System change Alterations in the complex actions, resources, structures, and relationships of a social or physical system within the system as well as with surrounding systems and influences that may be nested, interconnected, or interdependent.

Systems thinking The process of understanding and reasoning how elements in a complex whole influence one another and lead to or result in system behaviors.

Systems approach A robust, multidisciplinary problem-solving process with emphasis on determining the problem to be solved and then characterizing it through an iterative process until known processes can be brought to bear in resolving it.

Systems philosophy A way of thinking about and dealing with complex systems and their components.

Teachable agent A type of pedagogical agent that learns and improves as a result of interactions with human learners.

Teacher education A formal process for training primary and secondary teachers for classroom positions, most commonly through initial coursework in higher education and including ongoing professional development for practitioners.

Teacher technological knowledge The knowledge teachers have for effectively integrating technology in their teaching.

Teaching Guiding, showing, training, and otherwise facilitating the construction of knowledge and skills.

Technological, pedagogical and content knowledge (TPACK) Refers to the multiple and interconnected layers of professional knowledge (technological knowledge, pedagogical knowledge, content knowledge) that teachers need to integrate technology into learning and instruction.

Technology The application of knowledge to solve practical problems and change or manipulate human surroundings; technology includes the use of materials, tools, techniques, and more; technology involves knowledge, machines, techniques, systems, and so on in order to solve a problem or perform a specific function.

Technology integration Creating, using, and managing innovative and appropriate technological processes and resources to enhance learning and performance; the effective implementation of educational technologies to accomplish intended learning outcomes; the practice and art of incorporating technology into educational contexts; the use of informational and educational technology in instructional settings to support learning.

Technology readiness Possession of knowledge and skills preparing one to become a productive technology-using member of modern society.

Technology transfer The process of transferring or sharing knowledge, technological resources, and devices, methods of manufacturing, and other information among universities, governments, or other institutions.

Technology-enabled assessment Assessment that utilizes technology to facilitate and improve a teacher's ability to measure student learning outcomes.

Textbooks Publications used to teach a subject, especially in the context of formal education.

Theory of change The evidence or research-based rationale that explains how and why a project or program (an intervention) will transform a problematic state of affairs into a desired state of affairs.

Toy Play objects or materials usually designed for children.

TPACK See technological, pedagogical, and content knowledge.

Training A systematic approach to learning and development to improve individual, team, and organizational effectiveness; instruction intended to improve performance or support learning of a specific level of knowledge and skill required to perform some aspect of a job or task.

Transfer of learning Generalization of learning to novel situations that go beyond tasks learned.

Transfer of responsibility The student's assumption of control of a task that was previously scaffolded.

Transformative policy Political or administrative procedures that allow for experimentation or testing of ideas; in this case, with reference to using technologies in teaching and learning.

Usability The ease with which the intended audience (called users) can achieve the intended goals or objectives for a product, service, or software, as assessed using observation, measurement, and heuristic review.

Virtual worlds Immersive simulated environments in which a participant uses an avatar (a digital representation of oneself) to interact with digital agents, artifacts, and contexts.

Visual arts Fine and applied visual art forms, including drawing, painting, photography, sculpture, and video and filmmaking.

Visual arts education Teaching and learning related to the visual arts.

Web 2.0 A term coined to cover Web applications that allow users to create and share information, and collaborate on the Web; second-generation Internet-based services that include tools that let people collaborate and share information online, such as social networking sites, wikis, communication tools, and folksonomies.

Web-based learning environments The result of the instructional design/engineering process when delivered on the Web.