
Index

A

Aarnoutse, C.A., 368

Abrami, P.C., 239

Abu-Issa, A., 426

Academic emotions, optimization, 67–68

Achievement Emotion Questionnaire (AEQ), 71

ACT. *See* Active citizenship through technology (ACT)

Action research

CARN, 169

computer based technology, 169

contemporary movement, USA, 163

critical-emancipatory action research, Australia, 163

data analysis, 166

definition, 162

educational research, 165

and educational technology

courses, 168

integration, 168

time, 168

TPACK, 168

emancipatory action research, 168

engaging students, 165–166

ethical considerations, 165

implementation and reflection, 167

movement, UK, 162–163

PAR and PGIS, 167, 169

political, personal and professional, 164

process, data collection, 165

projects, 165

researcher's journal, 166

research groups, 167

selection, focus, 165

subcategories, 165

technology-rich instruction, 169

triangulating data, 166

in USA, Great Britain and Australia, 162

Active citizenship through technology (ACT), 575

Activity theory (AT)

actual contextual factors, 152

and ANT, 153–154, 157, 158

applications, 152, 157

contextual framework, 157

contradictions, 153

“development”, 153

division of labor, 152

dynamics and conflicts change, 153

and ETR (*see* Educational technology research (ETR))

framework, 152–153

implications, 158–159

individual goal-based actions and operations, 152

individual to societal learning, 152

learning, 151

methodological tool, 157

modern technologies and expectations, 151

multi-voicedness, 153

second-generation activity system triangle, 152

transformed object, 152

Vygostky's model, 152

Actor network theory (ANT), 153–154, 157, 158

ACT* theory. *See* Adaptive control of thought (ACT*) theory

ADA. *See* Americans with Disabilities Act (ADA)

Adam, S., 351

Adams, P.C., 485, 494

Adams, S., 33

Adams, W.K., 528

Adaptive control of thought (ACT*) theory, 10

Adaptive hypermedia systems (AHSs), 10

Adaptive learning technologies

affective states, 773

cognitive abilities, 772–773

context and environment, 774–775

desktop-based learning, 775

dynamic modeling approach, 770

individualized learning experiences, 770

learning material/activities, 769

learning styles, 771–772

LMSs, 769

mobile, pervasive and ubiquitous environments, 775

mobile settings and desktop-based, 770

research prototypes, 776

types, information, 776

Adaptive system

AI and EDM, 432

description, 430

developers and instructors, 431

method, 431

source, 430–431

target, 431

time, 431

Adcock, A.B., 760, 764

ADDIE. *See* Analyze, design, develop, implement and evaluate (ADDIE)

Advanced Research Projects Agency-Education (ARPA-ED), 629

AECT. *See* The Association for Educational Communications and Technology (AECT)

AEQ. *See* Achievement Emotion Questionnaire (AEQ)

- Affective artificial intelligence in education (AIED), 10
 Affective states
 collaborative student modeling approach, 773
 description, 773
 formal and supportive comments, 773
 learning process, 773
 Affordability, instructional design and job aids, 661
 Affordances
 interaction opportunities, 753
 and limitations, VW
 additional limitations, 728
 assessment, 727–728
 communication and collaboration spaces, 726–727
 design mechanics, 726
 experiential learning, 727
 identity exploration, 726
 meta-analysis, 726
 spatial simulation, 727
 Web 2.0 applications, 753
 Agent-based ITSs, 428
 Aguinis, H., 40
 AHSSs. *See* Adaptive hypermedia systems (AHSSs)
 AI. *See* Artificial intelligence (AI)
 AIED. *See* Affective artificial intelligence in education (AIED)
 Ainsworth, S.E., 726, 809
 Akar, G.B., 771
 Akbulut, Y., 843
 AKOVIA. *See* Automated Knowledge Visualization and Assessment (AKOVIA)
 ALA-reader, knowledge representation
 application, 290
 foundation, 289–290
 Albright, M., 258
 Alessi, S., 455
 Aleven, V.A.W.M.M., 504, 520
 Alexander, C., 610
 Al-Fadhl, S., 354
 Alfes, K., 620
 Alignment
 and constellations of practice, 911
 fostering research, 911
 perspectives, 911
 Allaire, J.C., 268
 Allen, M., 257
 Almond, R.G., 541
 Alnoaimi, T., 889
 Al Otaiba, S., 598
 Alsop, G., 915
 Alternative assessment, 302
 Altrichter, H., 162, 165
 Altschuld, J., 250
 Amandi, A., 426, 771
 Amendum, S.J., 597
 The American Society for Training and Development (ASTD), 40
 Americans with Disabilities Act (ADA), 118
 American University in Cairo (AUC), 633
 Amery, J., 701
 Amsel, E., 454
 Analogical reasoning. *See* Reasoning models
 Analyze, design, develop, implement and evaluate (ADDIE), 116, 146
 common procedures, 83
 disorganized and unsystematic state, 611
 generic instructional design paradigm, 80, 82
 and HPT, 44
 and IDs, 40
 instructional design literature, 611
 rectilinear portrayals, 80
 systematic analysis and intervention, 40
 work flow, 42
 Anand, P., 35
 Anderson, A.F., 491, 493
 Anderson, C.A., 485, 491, 493, 497
 Anderson, J.R., 10, 60
 Anderson, R.C., 466, 467
 Anderson, T., 250
 Andrew-Ihrke, D., 351
 Andrews, C.J., 122
 Andrews, D.H., 79, 305, 610, 611
 Andrews, M.D., 858, 859
 Angeli, A.D., 761
 Angeli, C., 102, 107
 Angert, J.F., 899
 Anglin, G.J., 386
 Angrist, J., 240, 242–243
 Answer until correct (AUC), 36
 ANT. *See* Actor network theory (ANT)
 Anthony, J., 208
 Antonenko, P., 57
 Anuradha, K.T., 714
 Applications of CTA, healthcare training
 dental hygienists, 541–542
 nursing, 541
 physicians, 541
 surgery residents, 542
 Applied research
 english-language engineering education, 567
 networks and conferences, 568
 social sciences research, 568
 Approximation to English (ATE), 35
 AR. *See* Augmented reality (AR)
 Arbreton, A., 520
 Arcavi, A., 794
 Archambault, L., 105
 ARCS. *See* Attention, relevance, confidence and satisfaction (ARCS)
 Artificial intelligence (AI)
 challenges, 428–429
 development process, 429
 in education, 426
 human intelligence, 426
 ITSs (*see* Intelligent tutoring systems (ITSs))
 research, 426–427
 Artificial intelligence in education (AIED). *See* Artificial intelligence (AI)
 ASPIRE. *See* Astrophysics Science Project Integrating Research & Education (ASPIRE)
 Assessment
 informal learning
 CATs, 260
 concept mapping, 260
 definition, 258
 embedded, 260
 evaluation, 258
 interviews, 261–262
 journaling and reflective writing, 260
 learners creation, formative, 261
 measure, 259
 multiple-method approach, 259
 observations, 262
 online discussions, 260–261
 performance, 260
 purposes, 258–259
 quantitative/qualitative, 259
 read, think-aloud protocols, 262

- rubrics, 261
self and peer reviews, 260
surveys, 261
test and quizzes, 259
web resources, 263
wikis, 260
- problem solving
analogue comparison, 273
classification, 270–271
coding schemes (see Coding schemes, problem-solving processes)
cognitive skills (see Cognitive skills assessment, problem solving)
description, 269
forms, 269, 270
knowledge structure, 270
multiple, 285
performance, 274
physical scenario, 271, 272
problem-posing stimulus, 271, 272
rubrics (*see Rubrics, problem solving assessment*)
student-construction, 280
text editing and jeopardy questions, 271, 272
translation, key propositions, 270
well-structured problems, 269
- students' literacy development
NETP, 595
student writing (see Student writing, assessment)
- Assessment standards, ICT
computer-based tests, 326
device and economic resources, 326
educational scenarios, 326, 327
evaluation, 326
paper-and-pencil tests, 326
software and hardware, 326
teachers, 326
VLE/LMS, 326
- The Association for Educational Communications and Technology (AECT), 6, 116, 897
- ASTD. *See The American Society for Training and Development (ASTD)*
- Asterhan, C.S.C., 440
- Astleitner, H., 69–71
- Astrophysics Science Project Integrating Research & Education (ASPIRE), 457–458
- AT. *See Activity theory (AT)*
- ATE. *See Approximation to English (ATE)*
- Atkinson, R.C., 374
- Atkinson, R.K., 497
- Attention, relevance, confidence and satisfaction (ARCS), 70, 71
- Atweh, B., 558
- AUC. *See Answer until correct (AUC)*
- Audio-Visual Communications Review (AVCR), 31
- Augmented reality (AR)
cognitive tool, 735
constructivist/interpretivist theories, 735
description, 733
exocentric and egocentric, 734
immersion, 734
- K-20 literature review (*see K-20 AR literature review*)
learning research teams and experiences, 735–737
learning theory, 734
- location-aware and vision-based, 733–734
real-world contexts, 735
smartphone capabilities, 734
transfer, 734
- Augustsson, G., 747, 749
- Ausubel, D., 90
- Authentic assessment, 302
description, 402
learning process, 403
mandatory characteristics, 402
with middle school students, 403
standards of, 402, 403
- Authentic learning environments
Adventures of Jasper Woodbury problem-solving series, 400–401
affordances, Web 2.0 developments, 406–407
anchored instruction, 400
arguments and discussions, 404
“artificial problems”, 405
and authentic tasks (*see Authentic tasks*)
characteristics, situated learning, 401
cognition and legitimate peripheral participation, 400
contemporary inventions, 401
defined, 400
description, 399–400
design and implementation, 407
direct instruction, 405–406
educational design researchers, 407
extensive observational studies, 401
formal educational settings, 401
formal education settings, 399
Gagné's Nine Events, instruction model, 400
highly realistic simulations, 405
information-rich resource, 400
interdisciplinary learning, subjects, 407
Jasper students performance, 401
philosophical foundation, “learning by doing”, 400
in practice, 403–404
in real work settings, 404
reasons, address real issues, 404–405
reported concerns, designs and relevant research, 404
restrictive administrative and assessment policies, 407
suspension of disbelief, 405
teachers, real experiences, 404
- Authentic tasks
assessment (*see Authentic assessment*)
characteristics, 401
coaching and scaffolding, 402
description, 402
expert performances and processes modeling, 402
multiple roles and perspectives, 402
reflection and articulation, 402
technology-based learning environments, 401
- Automated Knowledge Visualization and Assessment (AKOVIA)
application, 292–293
development, 293, 294
foundation, 292
framework, 292
measures, 291
- Automatic scoring
Spanish essays, 329
student, 333
- AVCR. *See Audio-Visual Communications Review (AVCR)*
- Ayres, P., 391, 497
- Azevedo, R., 504
- B**
- Baddeley, A.D., 759
- Baek, E.-O., 44, 46, 47
- Baek, J., 135

- Bailey, K., 485, 491
 Bain, K., 407
 Baker, E., 829, 833, 835
 Baker, R.S.J.d., 430
 Baker, S.J.d., 429
 Bakhtin, M.M., 622
 Ball, D.L., 894
 Balogun, J., 622
 Banathy, B.H., 376, 617, 618
 Bandura, A., 494, 759
 Banerjee, A.J., 240–242, 242, 244, 889
 Bannan-Ritland, B., 135
 Bannert, M., 646
 Barab, S.A., 131, 154, 155, 157, 405, 641, 725, 729
 Bares, W., 92
 Barkaoui, K., 495
 Barson, J., 78
 Bartlett, F.C., 4, 26, 28
 Barufaldi, J.P., 353
 Basu, S.J., 352
 Bates, A.W., 241, 859
 Battiste, V., 484
 Bauerlein, M., 824
 Baum, J.J., 843, 844
 Bavelier, D., 487, 491, 493, 497
 Baylor, A.L., 485, 491, 497, 758, 762, 763
 Becker, J.P., 555
 Becker, L.A., 206
 Beckerman, A., 486, 497
 Behavioral engineering model (BEM), 146
 Behaviorism and neo-behaviorism
 - classical conditioning, 24
 - Gestalt psychology in Europe, 23
 - programmed learning, 24
 - reinforcement, 24
 Behaviourist principles of learning, 419
 Beile, P., 137
 Beishuizen, J.J., 454, 506
 Belland, B.R., 506, 511
 Bell, B.S., 135, 363
Belvedere system, 510
 BEM. *See* Behavioral engineering model (BEM)
 Benefits of educational technology, 238
 Benkler, Y., 782
 Bennett, L., 844
 Bennett, S., 823
 Ben-Peretz, M., 896
 Benson, A.D., 158
 Benton, T., 596
 Bera, S., 708
 Bereiter, C., 132, 441
 Berliner, D.C., 27
 Berlo, D.K., 373
 Berlyne, D.E., 469
 Berman, N., 858, 859, 861
 Bernard, R.M., 239, 240, 243
 Bernhard, J., 567
 Bers, L.W., 575
 Berson, M.J., 576, 577
 Berthoff, A., 163
 Besnard, D., 540
 Betz, J.A., 485, 492
 Bialo, E.R., 207
 Bichelmeyer, B., 80
 Bickman, L., 248
 Bickmore, T., 761, 762
 Bijker, W.E., 122
 Biklen, S.K., 222
 Bingham, T., 256
 Birabasi, A.L., 336
 Birchfield, D., 533, 812
 Bishop, A., 551, 552
 Bishop-Clark, C., 440
 Bishop, M.J., 593
 Bitgood, S., 262
 Black, P., 260
 Blikstein, P., 683
 Blood oxygenation level-dependent (BOLD), 52
 Bloom, B.S., 22, 90, 608
 Blumenfeld, P.C., 646
 Boehm, B., 82
 Bogdan, R.C., 222
 BOLD. *See* Blood oxygenation level-dependent (BOLD)
 Boling, E., 95, 374, 376, 651, 652, 655
 Boote, D.N., 137
 Boot, E.W., 654
 Borko, H., 162
 Borokhovski, E., 239
 Borrego, M., 567
 Borun, M., 261
 Borup, J., 843
 Boshuizewn, H.P., 362
 Boucher, S., 701
 Boud, D., 414, 419
 Boughton, D.G., 582
 Bouzeghoub, A., 791
 Boyd, G.M., 377
 Boyer, E.L., 566
 Boyle, M., 506
 Bozeman, B., 251
 Braak, S.W., 795
 Bradley, B., 135
 Bradlyn, A.S., 484
 Brahnam, S., 761
 Branch, R.M., 78, 83, 84, 317, 611
 Brand-Gruwel, S., 362, 363, 367, 368, 404
 Brandt, C., 655
 Brannon, c., 497
 Bransford, J.D., 400
 Brause, R.S., 166
 Bressler, L., 228
 Brethower, D.M., 42
 Brewer, W.F., 412, 454
 Breyer, F.J., 541
 Brice, J. Jr., 619
 Briggs, L.J., 608–609, 611
 Britt, D.W., 376
 Brockett, R.G., 362
 Broer, T., 154
 Bromme, R., 367
 Brooks, A., 706, 707
 Brown, A.L., 132, 466, 506, 553
 Brown, J.S., 349, 400, 401
 Brown, R., 617
 Brown, S.J., 484, 485, 497
 Bruce, B., 584
 Bruner, J.S., 4, 90, 503, 504, 682
 Brunner, C., 340
 Brush, T.A., 107, 506, 842
 Brusilovsky, P., 770
 Buck, R., 66
 Bullen, M., 822

- Bull, G., 108
Bull, S., 426
Burghardt, M.D., 675
Burgos, J.V., 782
Burke, S.C., 747, 750
Burk, F.L., 606
Burkhardt, H., 131, 137
Burkman, E., 897
Burnett, M., 747, 750
Bushman, B.J., 497
Butler, D., 414
- C**
- CAD. *See* Computer assisted design (CAD)
Calao, J., 486
Calderhead, J., 895
Calderwood, R., 472
CALL. *See* Computer-assisted language learning environments (CALL)
Callison, D., 403
Camaioni, L., 497
Cambell, D., 248, 251, 252
Campbell, D.T., 203
Campbell, J., 542, 544
Campbell, K., 652
Campbell, W.K., 820
Campo, M., 426, 771
Candler, C., 858, 859
Cantrell, P., 675
CAQDAS. *See* Computer assisted qualitative data analysis (CAQDAS)
Carless, D., 418, 419
Carlock, D., 715
CARN. *See* Collaborative Action Research Network (CARN)
Carney, R.N., 386
Carnoy, M., 244
Carpenter, T.P., 473
Carr, W., 163
Carson, S., 783
Carter, J., 626, 635
Caruso, J.B., 821
Carvajal, D., 229
CASA. *See* Computers as social actors (CASA)
Case study, qualitative research
beginning to gain prominence, 185
description, 182
ECT, 182–183
educational research and qualitative tradition, 185–186
ethnography, 183
evidentiary standards, 186
grounded theory, 183–184
internal problems, 186
issues and trends, studying groups, 183, 184
methodologists, 182
qualitative-quantitative divide, 182
systematic empirical research, 182
Cassell, J., 703, 706
Castano-Munoz, J., 244
CAT. *See* Computerized adaptive tests (CAT)
Cattell, R.B., 205
Caudill, J., 782
Causal attribution, 69, 71
Causal expectancies, 69, 71
Cavanaugh, C., 168
CBI. *See* Computer-based instruction (CBI)
CEA. *See* Cost-effectiveness analysis (CEA)
Cennamo, K.S., 84, 257, 652, 653, 845
- Center for Applied Research in Education (CARET), 636
Centre for Space Science and Technology Education in Asia and the Pacific (CSSTEAP), 636
Century, J., 251
CERQ. *See* Cognitive Emotion Regulation Questionnaire (CERQ)
Certified First Responder (CFR), 406
Certified Performance Technologists (CPTs), 40, 42
Certified Professionals in Learning and Performance (CPLPs), 40
Cervantez, R., 890
CFR. *See* Certified First Responder (CFR)
Cha, H.J., 771, 772
Champy, J., 616
Chandler, P., 391, 497
Chang, C.-W., 353, 405
Chang, C.Y., 353
Change agent
dramatic changes, 615
human performance, 615
models, 616
research (*see* Research, change agency)
theories and research (*see* Change management)
Change management
agency, 617–618
diffusion to participation, 616–617
Chang, K.-E., 491
Chao, C.-J., 543
Chapanis, A., 464
Chapelle, C., 521
Characteristics, smart toy
categorizations, 702
child playing, rosebud, 702
concepts/skills, 703
electronic sensors, 702
purposeful tasks, 702
sifteo, 702, 703
StoryTech, 702, 703
Charsky, D., 577, 643, 822
Chase, C., 762
Chase, M., 354
Chater, N., 472
Chen, E., 336–337
Chen, G.-D., 405
Cheng, P.C.H., 809
Children's engineering
academic programs and curricula, 674
age and grade level, 674
design in schools, 674–675
desktop manufacturing (*see* Desktop manufacturing)
K-12 education, 673
personal manufacturing machines, 674
STEM subjects, 674
The Children's Internet Protection Act (CIPA), 120
The Children's Online Privacy Protection Act (COPPA), 120
Ching, Y.-H., 747, 749, 750
Chinn, C.A., 412, 414, 451, 454, 456
Choi, S., 762, 764
Cho, K.L., 278, 279, 284, 506
Cho, V., 337
Choy, D., 844
Chreim, S., 619
Christensen, R., 204, 214
Christensen, T.K., 657
Chuang, H., 747, 748
Chu, H., 714
Churchill, D., 899
CI. *See* Cooperative inquiry (CI)

- Cifuentes, L., 143, 147, 149
 Cilesiz, S., 880
 CIPA. *See* The Children's Internet Protection Act (CIPA)
 Civic education
 computers, smart phone and internet, 573
 democratic citizens, 573
 engagement and participation, USA, 573
 internet influence
 ACT, 575
 online communities and deliberation, 575
 presidential elections, 573–574
 resources, 573
 social justice and foster responsibility, 573
 survey, 573
 user-centered and Web sites, 573
 video games, 575
 Web-based simulations, 575
 K12 social studies, 573
 literature, 573
 Clarà, M., 442
 Clarebout, G., 518–522, 645
 Clariana, R., 417
 Clark, D., 256, 257, 353
 Clarke-Midura, J., 727, 729, 730
 Clark, F.E., 899
 Clark, R.E., 6, 32, 34, 406, 540, 542–545, 643–644, 646, 762, 764, 860
 Clarkson, E., 791
 Classroom assessment techniques (CATs), 260
 Classroom design and technology
 curriculum materials, 899
 education, 899
 examination, 899
 higher-quality lesson planning, 900
 interrelationship, IDT, 898–899
 preservice courses, 899
 private theories, 899
 prospective, 900–901
 seminar, 899
 student-centered approaches, 899–900
 teaching, 900
 Web-based units, 899
 Clavero, J., 714
 Clement, J., 471
 Clinton, G., 404, 655
 CLT. *See* Cognitive load theory (CLT)
 CMC. *See* Computer-mediated communication (CMC)
 CMDA. *See* Computer-mediated discourse analysis (CMDA)
 CNC. *See* Computer numerical control (CNC)
 Cobb, P., 135, 553, 556–558
 Cobos, R., 506
 Cochran, K.F., 102
 Cochran-Smith, M., 162–164, 166, 169
 Coding schemes, problem-solving processes
 audiotaping/videotaping, 283
 co-constructed knowledge, 284–285
 computer-mediated *vs.* face-to-face communication, 284
 identification, 283
 message based DFCS, 284
 rubrics, 283
 student performance, 283
 verbal protocol analysis, 283–284
 Coetzee, J.S., 146, 147, 149
 Coffield, F., 771
 Cognitive abilities
 CTM, 772
 definition, 772
 Felder–Silverman learning style model, 773
 learners' behavior and performance, 773
 and learning styles, 773
 research, adaptivity, 772
 Cognitive appraisal, 70
 Cognitive Emotion Regulation Questionnaire (CERQ), 71
 Cognitive load theory (CLT), 759
 alpha and theta band power, ERD%, 57
 EEG-fNIRS, 57
 high temporal resolution, EEG, 57
 learners' mental workload, 57
 long-term memory, 58
 neuroscience provides tools, 57
 neuroscientists, 57
 temporal dimensions, 57
 “working memory load”, 58
 working memory resources and interaction, 57
 Cognitive processes, game-based learning
 ambiguity, findings, 492
 description, 491
 EEG activity, proactive reaction, 491
 game-playing surgeons, 491
 guidance and animated agents, 491–492
 and psychomotor processes, 491
 skilled *Tetris* players, 491
 visual abilities, games to non-players, 491
 Cognitive resource theory
 extraneous cognitive load, 26
 instructional design, 26
 problems formats, 26
 working and long-term memory, 26
 Cognitive skills assessment, problem solving
 causal reasoning, 281
 description, 280–281
 student models
 expert systems, 282
 guides, 282
 learners, 281
 learning system, 282
 physics, 281
 quality, 283, 284
 representation, mathematics and science problems, 281
 system dynamics tools, smog formation, 282–283
 Cognitive task analysis (CTA)
 applications, healthcare training (*see* Applications of CTA, healthcare training)
 computational data mining research, 546–547
 description, 539
 evidence-based CTA method, 544–547
 expertise (*see* Expertise, CTA)
 history, 539–540
 70 Percent Rule (*see* 70 Percent Rule, CTA)
 research, 546
 selecting analysts and experts, healthcare, 542
 100 Versions, 543–545
 Cognitive tools
 children's knowledge construction, 707
 interactive environment, 708
 kinetic energy changes, 707
 learner control, 708
 StoryTech, 707
 technology-based, 407
 Cognitive trait model (CTM), 772
 Cohen, D.K., 894
 Cohen, J., 206, 207
 Cole, S.W., 240–242, 484

- Collaboration scripts
definitions and guidance, roleholders, 443
micro and macro, 443
R&D, 444
research on, 443–444
social and epistemic, 444
- Collaborative Action Research Network (CARN), 169
- Collaborative learning
average level of participation, group work, 796, 798
climate changes, 795, 796
collaborative concept mapping, 795
constructed arguments, 795
CSCL, 438
decision-making process, 795
learning process, 795
MOOC's, 796
open source software project, 796, 797
SNAPP, 796
social network, 795
- TMBI
beyond classroom constraints, 533
challenges, 533–534
computer programming and video gaming tool, 533
description, 533
face-to-face, handheld devices, 533
positive impact, students' attitudes, 533
research, 534
visualizing code share contributions over time, 796, 797
- Collaborative tasks, Web 2.0
blogs, 748–749
documents and concept mapping, 749
wiki, 749
- Coller, B.D., 485, 492
- Collins, A., 132, 258, 400, 504, 510, 512, 652
- Collis, B., 155
- Collocated collaborative learning (CSCL)
biannual conference and international journal, 695
kinesthetic learning, 695
multiple users, 695
small-group work, 695
- Comeche, M.I., 204
- Common Core State Standards (CCSS), 342–343
- Communities of practice
audiences, 909–910
awareness and social processes, 914–915
contextual relevance, 908
design-based research, 915
developments, 915
educational communications and technology, 907
ethnographic approaches, 915
feature, 907
fostering (*see* Fostering research)
techniques, 914
- Compensating support devices, 518–519
- Competency. *See* Formative assessment
- Computational modeling, model-based thinking, 531
- Computer assisted design (CAD)
activities, 678
curricula/technology-enhanced learning system, 683
curriculum, 675
drafting tools, 679
hands-on model, 683
industrial applications, 679
- Computer-assisted language learning environments (CALL)
CMDA, 96
EFL and ESL, 95
- language learning, 95
online environments, 96
research methods and questions, 95–96
- Computer assisted qualitative data analysis (CAQDAS)
capabilities, 224
competition, 225
limitations, 224
literature, 224
mid-1990s, 224–225
networking project, 224
packages, 225
Web site, 225
- Computer-based instruction (CBI)
individual screens, learner, 34
normal lesson, 32
programmed instruction design, 32
white space, 35
- Computer games
assistance/guidance, players, 491
in evaluation, 495
improvements, cognitive and psychomotor processes, 491
professional and scientific meetings, 483
recommendations, design, 497
- Computerized adaptive tests (CAT), 327
- Computer-mediated communication (CMC)
discourse analysis/procedures, 179
online discourse, 178–179
- Computer-mediated discourse analysis (CMDA)
Blizzard's *World of Warcraft* and NCSoft's *Lineage* series, 94
CALL, 96
quantitative methods, 95
- Computer numerical control (CNC), 676
- Computer/paper-based scaffolding
description, 508–509
embedded, context-specific scaffolds, 509
generic scaffolds, 509–510
- Computers as social actors (CASA), 758
- Computer supported collaborative learning (CSCL), 27
acquisition, knowledge by individuals, 439
approaches, visualization, 795
argumentation skills, 439
assessing group processes
argumentation and relationships, 442
identification, interaction effects, 442
instructors, tool, 443
Lag sequential analysis, 442–443
measures and analysis, 442
research, 443
social network analysis and networked learning, 443
Tatiana tool, 442
temporal patterns, 442
- blending, F2F and Online, 440–441
- collaborative learning, 438
- computer technology, 438
- description, 437–438
- designing
collaboration scripts (*see* Collaboration scripts)
description, 443
pattern and pattern languages, 444
- facilitating argumentation, 795, 796
- F2F, 438
- F2F CSCL (*see* Face-to-Face (F2F), synchronous CSCL)
- knowledge-building, 439
- meta-analysis and systematic reviews, 438
- networked learning, 438
- social context, 798

- Computer supported collaborative learning (CSCL) (*cont.*)
 social interactions, 439
 synchronous online CSCL, 440
 technology, 438
 valuable flexibility, time and space, 438
 with Web 2.0 Technologies, 441
- Computer-supported intentional learning environment (CSILE), 9, 507–508
- Conati, C., 426
- Conative domain
 vs. cognitive and affective, 124
 early twentieth century, 124
 “ethics”, 124
 Reeve’s resurrection, 122
- Conceptual age learning
 K-12 schools, 92
 REAL, 92
 technology and curriculum, 92
 traditional/transitional learning environments, 92
- Confirmatory evaluation, 196–197
- Connected teaching
 teacher isolation, 628
transforming American Education, 635
- Conner, M., 256
- Connor, C.M., 596
- Conole, G., 785, 914
- Constantinou, C.P., 531
- Constructivist epistemology
 description, 877
 educational technology, 877, 879
 evaluation research, 878
 implementation, 879
 knowledge, 877
 language games, 877
 and learning theory, 877
 logic models, 877, 878
 needs assessment, 879
 perspectives, learner, 877
 program evaluation, 878
 scientific inquiry, 879
 USAFA students, 879
- Constructivist principles of learning
 “adjustment process”, 414
 internal and external feedback, 415
 multi-factorial workings, 414
 “response certitude model”, 414
 “sustainable feedback”, 414
 task performance, 414
- Context
 adaptive system, 774
 contextual information, 774
 definition, 774
 environmental data, 775
 learner characteristics, 774
 mobile technologies, 774
 personal data, 775
- Context-aware
 K-20 teaching and learning, 735
 smartphones and tablets, 733
- Context modeling
 adaptive support to learners., 770
 adaptive system, 775
 collaborative modeling approach, 774
 dynamic modeling approach, 770
- Contractor, F.J., 632
- Conversational agent, 757
- Cook, D., 857
- Cook, M., 809
- Cook, T., 248, 251, 252
- Cooperative inquiry (CI), 180–181
- Cooper, P.A., 374
- COPPA. *See* The Children’s Online Privacy Protection Act (COPPA)
- Corbeil, J.R., 715
- Corey, S.M., 162
- Cornelissen, F., 167
- Correa, T., 822
- Costabile, M.F., 486, 492
- Cost-effectiveness analysis (CEA)
 acceptance, specifications and standards, 495
 arguments, games in learning, 495
 calculation, 240–241
 computer technology, 239–240
 costs constant and variations, 495
 decision makers, 495
 description, 494
 distance education, 240
 estimation, 239
 games vs. conventional classroom instruction, 495
 impact, 239
 measurements, 239
 online instruction, 240
 research, 239
 ROI (*see* Return on investment (ROI))
- Costs of educational technology
 analysis and efficiency (*see* Efficiency)
 area, 244
 description, 237
 effectiveness (*see* Cost-effectiveness analysis)
 methodological issues, 243–244
 research, 245
 review, 245
 student learning, 245
- Cowell, D., 146
- Cox, M., 830
- CPLPs. *See* Certified Professionals in Learning and Performance (CPLPs)
- CPTs. *See* Certified Performance Technologists (CPTs)
- Craik, K.J.W., 465
- Crandall, B., 541
- Creswell, J.W., 182, 222
- Crippen, K., 105
- Critical mathematics education
 students and families, 557
 students’ lived experience, 557
- Croft, C., 223
- Cross, J., 256, 257
- Crossman, D.C., 146–148
- Cross, N., 656
- CSCL. *See* Computer supported collaborative learning (CSCL)
- CSILE. *See* Computer-supported intentional learning environment (CSILE)
- CTA. *See* Cognitive task analysis (CTA)
- CTM. *See* Cognitive trait model (CTM)
- Cuban, L., 114, 841, 858
- Cultural-historical theory
 communism claiming, 24
 cultural mediators, 25
 educational communications and technologies, 25
 internalization, 25
- Culture
 community involvement practices, 866
 digital learning environment, 866

- information systems design, 866
interface design metaphors, 867
online community, 868
type, interactivity, 867
- Culture in learning
computer technology, 355
definition, 347–348
description, 347
e-learning (*see e-learning*)
ethnography, 349
guidance, 355–356
implications, literature review, 355
information and communication technologies, 356
instructional strategies, 347, 356
integration, 349
literature, 349
mathematics (*see Mathematics education*)
perspectives and paradigms, 349–350
science (*see Science*)
studies, 348
theoretical and conceptual research, 348–349
- Culture-specific learning
applications, 351, 355
curriculum content, 355
mathematics, 351
pedagogy, 355
racial group, 348
science education, 352
- Cumming, G., 207, 210
- Cummings, R., 186
- Cunningham, D.J., 374
- Cvetanoska, M., 887
- Czerniewicz, L., 912
- D**
- Dai, D.Y., 496
- Dane, A., 251
- D'Antoni, S., 782
- Dass, P., 490
- Data acquisition
age appropriateness/lack of basic IT skill, 204
calculation, power, 203
compatibility, 204–205
description, 201
external validity, 203
HTML, 202
lack of universal access, 203–204
Mark sense/OCR, 202
mobile survey administration, 203
paper-based surveys, 202
reliability, data gathered online, 204
social networking movement, 203
21st century, 201
web-based approaches, 202–203
- Data analysis
CRC standard mathematical tables and formulae, 207–208
data mining, 205
descriptive statistics, 205
effect size calculators
Becker's online, 206–207
descriptive statistics, classroom reading level index, 207
measure, 206–207
hypothesis testing, 205
MS access pre/post pairs matchup, 206
online binomial (sign) test, 208
- purpose resources, 206
quantitative tools, 205
spreadsheet
effect size computations, 206
packages, 205–206
- statistical packages
Amos, 209
LISREL, 209
R Project, 208–209
SPSS, 208
- t*-test calculators, 206
- Data-based decision making. *See Data-driven decision making (DDDM)*
- Data-driven decision making (DDDM)
accountability measure, 336
action based, 339–340
analysis and interpretation, 339
classroom, 337
collection and analysis, 338
description, 335–336
establishing goals and inquiry process, 339
features, 338
framework, 336
growth, 337
guides, schools, 338
implications, educational research
and adoption, 341
CCSS, 342–343
evaluation and measurement, 342
quality, data systems, 341–342
value-added measures, 342
- public education, 338
- school/district level, 337
- state/federal level, 336–337
- student learning, 338
- student work and teaching, 339
- technological data systems, 340
- Data visualization
applications, 209
categories, 212
data mining, 209
display techniques, 209
- Eureqa, 212, 213
- hierarchical cluster analysis, 214–215
- late 1950s and early 1960s, 212–213
- letter wheel based, 213
- MacSpin, 216
- Mathematica, 212
- MATLAB®, 211
- measurement, 212
- Microsoft Space Telescope project, 216
- multidimensional, 214
- rank-sum analysis, 214
- spreadsheet packages, 210
- SPSS, 211
- Stanford Binet versions, 215–216
- three-dimensional space, centroids, 216
- WiSTTI Model, 210
- Wolfram Alpha, 211
- WorldWide Telescope Project, 216
- Davidson, J., 222–224, 229, 230
- Davidson, M.R., 591
- Davidson, R.A., 407
- Davis, E.A., 506, 512
- Davis, H.A., 70, 71
- Davis, M., 114, 115
- Davis, V., 643

- Dawley, L., 727, 729
- Dawson, K., 168
- DBAE. *See* Discipline-based art education (DBAE)
- DDR. *See* Design and development research (DDR)
- Deale, C.S., 404
- Dean, D., 455
- De Angeli, A., 492
- Dean, P.J., 45
- Decision Function Coding System (DFCS), 284
- Decision making
- description, 472
 - mental simulations, 472
 - probabilistic reasoning, 473
 - and problem-solving strategies, surgical experts, 540
 - RPD model, 472
 - schema-based, 472
 - situation awareness and mental models, 472–473
- Dede, C., 137, 529, 727, 729, 730
- De Freitas, S., 94
- deFreitas, S., 728, 729
- de Groot, A.D., 4
- de Jong, T., 58, 60, 452, 453, 455, 456, 460, 497, 506, 646, 810
- de Laat, M., 443
- Demetriadis, S., 425
- Denesenm, E., 494
- DeNisi, A., 415
- Denzin, N.K., 174, 175, 185, 222
- dePlatchett, N., 583
- de Rosnay, M.D., 780
- DeSchryver, M., 646
- Desha, C., 563
- Design
- architecture, 605
 - curiosity and exploration, 656
 - designers and designing, 653–654
 - in education, 655–656
 - human-computer interface design, 653
 - IBSTPI and ISTE, 651
 - instructional designers, 651–652
 - instructional design guidelines, 653
 - instructional models (*see* Instructional design (ID))
 - instructors, 652
 - judgment and character, 656
 - naïve/misconceptions, 653
 - studio-based education, 655
 - systematic process, 651
- Design and development research (DDR)
- activities and interests, 142
 - classification, 142
 - comprehensive case study, 146
 - computer-based training, 143
 - computer system, 144
 - conduct model research, 144–145
 - description, 142
 - designers working, 146
 - e-learning, 146–147
 - evaluation, 148–149
 - formative evaluation, learning game, 143–144
 - Gilbert's behavioral engineering model, 146
 - IDT field, 142
 - ISD process, 143
 - models and procedures, 142
 - multimedia curriculum, 144
 - multiple intelligence design model, 146
 - nature, 141
 - opinions, 141–142
 - performance support tool, teachers, 144
 - problems, 147–148
 - product and tool research, 147
 - projects, 142–143
 - researchers, 149
 - research projects, 142
 - settings and participants, research, 148
 - task-centered and peer-interactive course redesign, 143
 - transfer model, 145
 - validation research, 145–146
 - visual information, 145
 - web-based knowledge management system, 145
 - Web 2.0 system, community and teacher, 143
- Design and development tools. *See* Design and development research (DDR)
- Design and technology trends, visual arts
- DBAE, 582–583
 - ISTE and NAEA, 583
 - national visual arts standards, 583
 - NETS-S and ISTE, 583
 - theoretical influences, 583–584
- Design-based research, 34, 35
- Design experiments, 134, 135
- Design knowledge
- and skills, 652
 - studio curriculum, 655
- Design models. *See also* Instructional design
- decision-making context, 605
 - description, 605
 - ID and design, 606
 - ISD process, 606
- Design patterns and pattern languages, 444
- Design research. *See* Educational design research
- Design science
- artificial objects, 553
 - multidimensional nature, 559
 - systematic evaluation, 553
- Desimone, L.M., 186
- Desktop manufacturing
- automating, 675–676
 - CNC and CAD, 676
 - digital fabricators, 676
 - 3D printing, 676
 - 3D scanners, 675, 676
 - emergence, 676–677
 - FabLab, 676
 - motor skills and student achievement, 681
 - NAE award, 680
 - NSF-supported project, 680
 - in schools (*see* Schools, desktop manufacturing)
 - school science and mathematics, 680–681
 - virtual and physical representations, 682–683
- Developmental psychology
- cognitive development, children, 24
 - formal operational stage, 24
 - mental representations, 24
 - one-year-old infant, 24
 - sensorimotor stage, 24
- Dewey, J., 4, 132, 582, 659
- deWinstanley, P., 497
- Dey, A.K., 774
- Dholakia, U., 784
- Diamond, J., 262
- Diamond, S., 404
- Diaz, M.I., 204

- Dicheva, D., 792
Dichev, C., 792
Dick, W., 43, 82, 644, 898
Dierking, L.D., 256
Dietz-Uhler, B., 440
Digital fabrication
 characteristics, 677
 circuit boards, 676
 2D and 3D laboratory, 676
 manufacturers and consumers, 677
 post-secondary levels, 681
Digital literacy, 322, 323, 828
Digital natives
 Boomer Generation and Generation X, 820
 core technologies, 821
 demographic variables, 822
 digital/information age, 820
 ICTs, 822
 learning process, 823
 networking tools, 822
 social interaction and entertainment, 821
 social media tools, 822
 technology skills, 821
Digital texts
 customers and publishers, 715
 intellectual property, 716–717
 standard formats, 717
di Gregorio, S., 222, 223, 229
Dillenbourg, P., 438, 691
Dill, K., 497
Dills, C.R., 84
Din, F., 486, 492
Ding, N., 442
Dirkin, K., 762
Discipline-based art education (DBAE)
 constructivist approaches, 582
 disciplinary areas, 583
Discourse analysis, 178–179
Dittmer, A., 714
Di Vesta, F.J., 258, 260
Dobson, T.M., 747, 749, 752
Dodero, J., 801
Dodge, B., 831
Doering, A.H., 585
Doering, S., 261
Doerr, H.M., 465, 478
Dohn, N., 441
Domagk, S., 762, 763
Donchin, E., 484
Doolittle, P.E., 578
Dorsey, L., 82
Dorst, K., 655, 656
Doughty, P.L., 610
Dow, G., 390
Downes, S., 784
Dozois, A., 405
Driscoll, M.P., 14, 35, 372
Dror, I., 857
Duart Montoliu, J., 244
Dubberly, H., 610
Dueber, W., 405
Duffin, J., 783
Duffy, T.D., 497, 641, 645
Duffy, T.M., 374, 404, 406
Duflo, E., 240–242
Duguid, P., 400, 401
Duncan, R., 617
Duncan, S.M., 785
Dunn-Rankin, P., 213, 214
Dupeyrat, C., 520
Duschl, R.A., 453
Duval, E., 663
- E**
- Earle, R.S., 898
e-Books
 commodity and publishers, 718
 content, 712–713
 description, 711
 designing, classroom, 715, 716
 digitizing books, 716–717
 in educational contexts (*see* Educational contexts, e-Books)
 e-reader, 718
 hardware, 712
 K-12 contexts, 711
 printing press, 711–712
 professional communication and publishing, 717
 proof-of-concept projects, 719
 and publishers, 715
 reading habits, 718
 “rendering”, 717
 research, attitudes, 716
 software, 712
 system, 717, 718
 transformation process, 717
 use of, 712
- ECD. *See* Evidence-centered design (ECD)
- Eckblad, G., 469, 470
- Economic development, ICT, 885
- ECT. *See* Educational communications and technology (ECT)
- ECTJ. *See* Educational Communications and Technology Journal (ECTJ)
- EDM. *See* Educational data mining (EDM)
- Edmonds, G., 79
- Educational communications and technology (ECT)
 applications, 179, 181–182
 approaches and tensions, 175
 case study, 182–183
 educational studies, 175
 in Europe and Middle East, 175–176
 evidence-based practice, 185
 heated debate, 185
- Educational Communications and Technology Journal (ECTJ), 31
- Educational contexts, e-Books
 in classroom, 714
 instructors, 715
 in libraries, 714
 research, 713
 research on hardware, 713–714
 students, 714–715
- Educational data mining (EDM)
 applications, personalization, 430
 challenges, 430
 clustering techniques, 429
 discovery with models, 429
 prediction, 429
 relationship mining techniques, 429
 on research, 429
 text mining, 429–430

- Educational design research
 characteristics, 134
 communications and technology, 136
 complex “laboratories”, 132
 description, 134
 doctoral dissertation, 137
Educational Technology Research and Development, 137
 empirical insights and theoretical advancements, 132
 formative and summative evaluation methods, 133–134
 generalizability, 138
 on the Horizon, 138
 impacts, 137–138
 information richness and efficiency, 137
 interventions and practice, 133
Journal of Educational Computing Research, 137
 journals, 132
 knowledge claims, 133
 motives, 132
 optimizing processes, 137
 practical outputs, 136
 processes and programs, 131, 134
 products and policies, 131
 quality of research findings, 133
 research-based, 134
 scientific outputs, 135–136
 sectors, 132–133
 stemming, 132
 variation, 134–135
 Educational innovation, 563
 Educational modeling
 IMS learning design specification, 663
 knowledge activity, 667
 ontology-based, 667
 Educational policy, 886
 Educational psychology
 ETR&D, 32
 experimental research, 32
 Educational technology, 40, 78
 American education, 635
 capacity-building focus, 634
 cross-national education and research efforts, 634
 CSSTEAP functions, 636
 de facto language, 634–635
 dynamic interaction, 626
 EHHS, 636
 elementary principals, 633
 ESEA, 635
 ethics
 accessibility and universal design, 118–119
 ACT, 115–116
 characteristics, 116
 conversation, 113
 cross-cultural competence, 121
 current analysis, 117
 daily battle in headlines, 114
 DAVI, 115
 Davis’ logic, 114
 degree and certificate programs, USA and Canada, 117
 development models, 113–114
 digital divide and access, 119–120
 educational system, 125
 faculty responses, 117
 higher education curricula, 114
 “Institutes of Oratory”, 125
 intellectual property and open content, 118
 ISPI certification process, 116
 “Mega”, 115
 military profession, 114
 Nuremberg Code, 114
 parsimonious terms, 124
 philosophical consideration, 114
 policies, 125
 “practical ethics”, 114
 professional practice, 118
 reprints, 115
 and research, 125
 research and evidence-based theory, 116–117
 “reversal effect”, 124–125
 rival claims, 114
 security and privacy, 120–121
 social responsibility (*see* Social responsibility, ethics)
 “social responsibility”, 116
 survey responses, 117
 systematic treatment, 113
 “techne”, 114
 work on society, 115
 “worthwhileness”, 115
 ETR&D, 31–32
 ISTE and CARET, 636
 ITT, 632–633
 K-12 education, 633
 learning theories and technologies
 behaviorist, findings and principles, 12–13
 cognitivist, findings and principles, 13
 complex educational system, 15
 computer-enhanced learning environments and learner support, 10–11
 constructivism and socio-constructivism, 12
 experimental psychology, 12
 human activity, 15
 information processing and knowledge acquisition, 7–9
 intelligent computer-assisted learning and tutoring systems, 9–10
 internal and autonomous dynamics, 15
 knowing that and knowing how, 15–16
 learning sciences and instructional technology, 12
 learning seems unrealistic, 12
 open-ended computer environments, 11–12
 promote learning, 3–4
 sense practice, 4
 society and education, 4–5
 socio-constructivist, findings and principles, 14–15
 somewhat vague conceptual field, 5–7
 teachers and learners, 15
 transition steps, 15
 vice versa requires consistency and stability, 15
 national educational technology plan 2010, 627–629
 nature and influence, policy, 626–627
 “new technology”, 626
 NITRD and IES, 636
 OER, 842
 one-to-one computing initiatives, 841
 policy-driven educational technology practice, 629–631
 “Tea Party” candidates, 635
 US Department of Education funds, 636
 US federal policy, 632
 Educational technology research (ETR)
 characterization, 154
 constructivist learning environments, 155
 contextualized learning artifacts and system, 155–156
 historical analysis, activity system, 154–155
 improvement developmental cycles, 156–157

- learning tools, 154
manageable data, 154
reactions to innovation, 156
tensions and contradictions, 154
- Educational Technology Research & Development (ETR&D), 31–32
- Educational technology units (ETUs), 859
- Educational testing service (ETS), 329
- Education, Health and Human Services (EHHS), 636
- Education reform, ICT policies
curriculum, 886
and economic development, 886
ERfKE, 886
social equity, 890
and transformation, 885
- EEG. *See* Electroencephalography (EEG)
- EER. *See* Engineering education research (EER)
- EETT. *See* Enhancing Education Through Technology (EETT)
- Efficiency
cost-benefit, 238
cost-effectiveness, 238
cost-utility and cost-feasibility, 238
resource, 237–238
- EFL. *See* English-as-a-foreign-language (EFL)
- EHHS. *See* Education, Health and Human Services (EHHS)
- Eisenberg, M., 822
- Eisner, E.W., 585, 587
- Ejersbo, E., 135
- Ekeberg, S., 415
- Elders, E., 404
- e-learning
analysis, culture and learning, 353–354
communication, 354
international higher education, 354
learners influences, 354
learner's interactions, 354
perceptions and attitudes, students, 354
reviews, 354–355
synchronous and asynchronous, 354
technological supports, 354
- eLearning standards
educational modeling languages, 663
ICT-based learning platforms, 663
IMS-LD, 664
learning object paradigm, 664
RELOAD, 664
- Electroencephalography (EEG)
and ERPs
definition, 53
human brainwave rhythms, 53, 54
language-related components, 54
theta and alpha oscillations, working-memory, 53–54
tracking changes, cerebral blood flow, 53
- and fNIRS, 57
high temporal resolution, 57
learners' mental workload, 57
- Electronic books
E-book readers, 713
researchers and publishers, 713
usage patterns, 718
- Electronic mail (E-mail) management, 325
- Electronic medical records (EMR), 854
- Electronic Pedagogical Content Knowledge (ePCK), 103
- Electronic performance support system (EPSS), 144
- Elementary and Secondary Education Act (ESEA), 626–627
- Elementary and Secondary Education Act of 2001, 839
- Elen, J., 427, 518–522, 645
- Elgort, I., 747, 749, 752
- Eliahu, M., 489, 494
- Ellaway, R., 854, 857
- Elliot, A.J., 521
- Elliot, J., 162, 163
- Ellison, A., 203
- Ellison, N.B., 747, 751
- Elmore, R., 336
- Elwood, S., 169
- Ely, D.P., 115, 616
- Ely, K., 492, 493
- Emans, B., 506
- Embedded, context-specific scaffolds
definition, 509
in high school
science instruction, 509
social studies instruction, 509
in middle school, science instruction, 509
- Emdin, C., 353
- Emergency Medical Technician (EMT), 406
- Emotional experience
control-value theory, 71
learners' emotions, 69
models and approaches, 69–70
theory-driven interventions, 69
- Emotion measurement
description, 71
emotional responses, 72
instruments, 71
interventions and evaluation programs, 72
problems, 72
technologies, 71–72
- Emotion regulation
appraisal process, 69
appraises, 68
Bill values, 68
causal structure, 68–69
controllability of actions, 69
meaning structure, 68
people, 69
person's expectancy and perceived values, 68
- Emotion Regulation During Test Taking scale (ERT), 71
- EMR. *See* Electronic medical records (EMR)
- EMT. *See* Emergency Medical Technician (EMT)
- Ende, J., 417
- Endicott, L., 121
- Engeström, Y., 152, 153, 155–158
- Engineering education
academic status, 565
categories, 567
EER (*see* Engineering education research (EER))
Gartner hype cycle, 564
global development, 567
industrial revolution, 563
information technology, 563
pedagogical research and development centers, 565–566
R&D stage, 564
renewal transitions and, 563, 564
research, 566–567
social sciences investigation, 567
- Engineering education research (EER)
JEE and EJEE reports, 567
research agenda, 568
- English-as-a-foreign-language (EFL), 95, 96
- English-as-a-second-language (ESL), 95, 96
- English, L., 553

- Enhancing Education Through Technology (EETT)
 annual technology survey, 632
 district and school implementation, 630
 and SEAs, 630
 temporary bonus, 627
- Ennis, R.H., 278
- Entertainment Software Association (ESA), 94, 483
- ePCK. *See* Electronic Pedagogical Content Knowledge (ePCK)
- Epistemology, 96
- EPSS. *See* Electronic performance support system (EPSS)
- Ercolani, P., 497
- Erlanson, B.E., 729
- Erstad, O., 830
- ERT. *See* Emotion Regulation During Test Taking scale (ERT)
- Ertl, B., 444
- Ertmer, P.A., 14, 85, 656, 845
- ESA. *See* Entertainment Software Association (ESA)
- Escribe, C., 520
- ESEA. *See* Elementary and Secondary Education Act (ESEA)
- Eshet, Y., 492
- ESL. *See* English-as-a-second-language (ESL)
- Espinosa, L., 492
- Essential processing
 managing, 391
 modality principle, 391–392
 pretraining principle, 391
 probability problems and algebra equations, 391
- Estelle, L., 714, 718
- Estes, F., 540
- Ethics across the curriculum
 current analysis, 117
 degree and certificate programs, the USA and Canada, 117
 faculty responses, 117
 professional practice, 118
 research and evidence-based theory, 116–117
 survey responses, 117
- Ethics as design, 123
- Ethnography, qualitative approach, 183
- ETR. *See* Educational technology research (ETR)
- ETR&D. *See* Educational Technology Research & Development (ETR&D)
- ETS. *See* Educational testing service (ETS)
- ETUs. *See* Educational technology units (ETUs)
- European Computer Driving License Foundation (ECDLF), 829
- Evaluation
 games
 reduce, test anxiety, 496
 research, psychometric properties, 496
 “stealth” paradigm, 495–496
 informal learning, 258
- Evans, J.S., 471
- Evans, M.A., 442, 691, 696
- Event-related potentials (ERPs). *See* Electroencephalography (EEG)
- Evers, J.C., 223
- Evidence-based CTA method
 assessment, 545, 546
 guided training design, 545–547
 knowledge captured in interview, 544–545
 research, healthcare instruction, 544
- Evidence-based practice
 audiences, 909
 digital scholarship, 914–915
 policy, 909
- Evidence-centered design (ECD), 314
- Experimental design. *See* Program evaluation
- Expertise, CTA
 automated and nonconscious, 540
 employer satisfaction, healthcare graduates, 541
 experts don’t know what they don’t know, 540
 meta-analysis, 540–541
- External validity
 CBI screen design, 34, 35
 individual screen design, 34
 vs. internal, 35
 participants, 35
 realistic learning, 35–36
- Extraneous processing
 coherence principle, 388–389
 expectation principle, 390–391
 reducing, 388, 389
 redundancy principle, 390
 seductive details, 389
 signaling principle, 389
 spatial contiguity principle, 390
 temporal contiguity principle, 390
 visual signaling, 389–390
- Eysenbach, G., 860
- Eysink, T.H.S., 452
- F**
- Facer, K., 739
- Face-to-Face (F2F), synchronous CSCL, 439–440
- Falcao, T.P., 439
- Falconer, I., 911
- Falk, J.H., 256, 258, 259, 262
- Fall, L.H., 858
- The Family Educational Rights and Privacy Act (FERPA), 120
- Farrell, G., 884
- Fear, envy, anger, sympathy and pleasure (FEASP)
 classroom, 70
 “emotionally sound instruction”, 69
 Keller’s ARCS model, 71
- FEASP. *See* Fear, envy, anger, sympathy and pleasure (FEASP)
- Feedback models
 constructivist (*see* Constructivist principles of learning)
 cybernetics to sandwich making, 419–420
 definition, 412–413
 description, 411–412
 on educator, 412, 416
 educator and learner perspectives, 418–419
 higher education and professional education, 412
 idealised and actual practices, 419
 implications, program design, 420–421
 learner performance and motivation, 415–416
 learner surveys, 412
 mechanical model, 413–414
 observations, *in situ*, 419
 properties, 413
 quality (*see* Feedback quality)
 and self-evaluation, sustainable learning, 421
 self-evaluative capacities, 419
 self-monitoring and self-regulation, 419
 traditional “feedback rituals”, 412
- Feedback quality
 behaviours and specific performances, 417
 “disguised corrective strategies”, 417
 properties, 416
 qualities and perceived qualities, “teacher”, 417–418
 self-concept formation, 416–417
 structure feedback messages, 416

- tension for educators, 417
timing, 417
- Feenstra, E., 442
- Felder, R.M., 771–773
- Felder–Silverman learning style model, 773
- Feldon, D.F., 540, 543, 544
- Ferdig, R.E., 866
- Ferguson, C.J., 486, 493, 494
- Ferguson-Smith, A., 420
- FERPA. *See* The Family Educational Rights and Privacy Act (FERPA)
- Fery, Y.A., 497
- Fessakis, G., 747–749
- F2F. *See* Face-to-Face (F2F), synchronous CSCL
- Fidelity, 251–252
- Fiedler, K., 470
- Fielding, N., 223
- Filsecker, M.K., 833
- Finkel, E., 465
- Finkelstein, N.D., 809
- Firestone, W.A., 138
- Fischbein, E., 552
- Fischer, C.L., 349
- Fischer, F., 442, 444, 520, 522
- Fischer, K.M., 143
- Fitzsimmons, J., 404
- Flagg, B., 249
- FLE3. *See* Future Learning Environment (FLE3)
- Fleming, M., 372, 375, 377
- FLEs. *See* Flexible learning environments (FLEs)
- Fletcher, J.D., 484, 495, 497
- Flexible learning environments (FLEs)
assessment, 364
components, 364
design, 364
feedback, 368
guiding, 364
implementation, ISDL model, 364–365
instructional interventions, 367
learning tasks, metadata, 365
modeling, 367–368
portfolio development, 365
process worksheets, 367
prompts, 367
- Flowerday, T., 497, 765
- fMRI. *See* Functional magnetic resonance imaging (fMRI)
- fNIRS. *See* Functional near-infrared spectroscopy (fNIRS)
- Fontana, L., 486, 494, 497
- Fontijn, W., 704
- Ford, J.D., 621
- Ford, L.W., 621
- Formative assessment
classroom, 310
and measurement, 310
NCLB, 309–310
recommendations, teachers, 316–317
and stealth (*see* Stealth and formative assessment)
and summative (*see* Summative and formative assessment)
- Formative evaluation, 195, 259
- Formative research, 134
- Fostering research
artifacts, 912
“constellations of practice”, 911
design patterns, 912
experts, 913
interventions, 911
LAMS, 912
- language, 913
outputs, 915
practical value, 911
practitioners, 911, 912
processes, 911
researchers functions, 913–914
sharing evidence, 912
standardized representations, 912
traditions, 911
- Fraas, J.W., 496
- Fraj, F., 889
- Francom, G., 143, 147, 149
- Frechette, C., 762
- Frederiksen, C.H., 809
- Freeman, C., 251
- Freeman, H.E., 495
- Frei, P., 704
- Freire, P., 164
- Frensch, P.A., 497
- Freudenthal, H., 552–557
- Friesen, N., 911, 914
- Friese, S., 222
- Front-end analysis, CTA, 547
- Fryer-Edwards, K., 857
- Fullan, M., 617
- Functional magnetic resonance imaging (fMRI)
advantages, 52
application, 53
BOLD, 52
hemoglobin, 52
participants, headphones, 52–53
positron emission tomography, 52 “see” changes in brain activity, 52
- Functional near-infrared spectroscopy (fNIRS)
applications, 53
functional and practical limitations, 53
learning and instruction, 53
neurotechnology penetration, 53
temporal resolution, 53
- Funk, S.G., 682
- Future Learning Environment (FLE3), 508
advisory, 365–366
development, learning ability, 360–361
functions, 368
practical implications, 368
and SDL (*see* Self-direct learning (SDL))
self-assessment, 367
and SRL (*see* Self-regulated learning (SRL))
and STEPP, 366
students’ ability, 367
- G**
- Gagné, R.M., 3, 7, 22, 40, 90, 608, 609, 611, 910
- Gaible, E., 884
- Galston, W.A., 575
- Game-based learning
affect, behavior and performance, 493
aggression, 493
attitudes toward, 494
attraction of, 498
CEA (*see* Cost-effectiveness analysis (CEA))
data mastering, external sources, 493
enhancing cognitive processes (*see* Cognitive processes, game-based learning)
ESA, 483
evaluation (*see* Evaluation, games)

- Game-based learning (*cont.*)
 experiential/constructivist, 484
 games with pro-social content, 494
 instructional delivery systems, 496
 instructional methods, 492
 integration, courses of study, 492
 motivational qualities, educators and trainers, 483
 negative relationships, school learning and computer game playing, 493
 recommendations, design, 497–498
 research, 492
 research and theoretical development, 496
 research, games and learning, 484–490
 school learning, 493
 taxonomy, 496–497
 technology-based instruction, 492
 time, 492
 transfer, games to external tasks (*see* Transfer of learning)
- Garcia, E., 430
 García, P., 426, 771
 Gardner, P., 747
 Garland, V.E., 844
 Gay, G., 865–867
 Gee, J.P., 95, 258, 261
 Geertz, C., 183
 Gehlbach, H., 577
 GEL instructional demonstration based on central line CTA, 545, 547
 Generational differences
 amusement and social communication, 825
 beliefs and behaviors, 819
 common location, history, 819
 curriculum development, 824–825
 diversity, 823
 educational design research, 825
 labels and dates, sources, 818
 location, history, 819
 perceived membership, 819
 speed, transition, 825
 technology integration, 823–824
 theories and assertions, 819
 traditional retirement age, 817
- Generative processing
 anchoring principle, 393
 concretizing principle, 393
 elaboration principle, 393
 fostering, 392
 guided discovery and questioning principle, 393
 image and embodiment principle, 393
 multimedia principle, 392
 personalization principle, 392
 testing and self-explanation principle, 393
 voice principle, 392–393
 worked-example principle, 393
- Generic scaffolds
 definition, 509
 in high school, science, 510
 intersubjectivity, customization and transfer of responsibility, 510
 in middle school
 science, 509–510
 social studies, 510
 in university, economics, 510
- Gentile, D.A., 487, 493, 495–497
 Gentry, L.B., 843
 Gentry, M., 403
 Georgiadou, E., 425
 Gerjets, P.H., 12
- Gershfenfeld, N.A., 676
 Gestalt psychology
 “einstellung”, 23
 implications, 23
 instruction and teaching, 23
 theory, 23
 Wertheimer’s approach, 23
- Gibbons, A.S., 6, 376, 377, 610
 Gibbons, J.D., 212
 Gibson, W., 179
 Gigerenzer, G., 472
 Gijlers, H., 453, 455, 506
 Gilbert, E., 797
 Gilbert, L., 226
 Gilbert, T.F., 40, 43
 Gillies, R.M., 506
 Gill, M.G., 895
 Ginns, P., 390, 392
 Glanz, J., 165
 Glaser, R.E., 132, 302, 453, 540
 Glass, G.V., 242
 Glazewski, K.D., 506
 Glesne, C., 166
 Glos, J., 703
 Goert, J.D., 533
 Goel, V., 654
 Goetz, J.P., 222
 Goetz, T., 469
 Gogus, A., 854
 Goldberg, L.B., 576
 Goldman, S.R., 596
 Goldstone, R.L., 809
 Gong, Z., 591
 Gonzalez-Sanmamed, M., 847
 Goodson, I., 162
 Goodson, L.A., 79, 610, 611
 Good, T., 644
 Goodyear, P., 83, 444
 Gopher, D., 484, 487, 491, 497
 Gorard, S., 175
 Gordon, J., 610
 Gordon, R., 406
 Goswami, U., 60
 Grabinger, R.S., 34, 35, 93
 Grabowski, B.L., 378, 771
 Graesser, A.C., 763
 Graf, S., 771–775
 Graham-Rowe, D., 713
 Grant, L., 751
 Gräsel, C., 522, 810, 811
 Gravemeijer, K., 135, 556, 557
 Gray, L., 841
 Green, C.S., 487, 491, 497
 Greene, B.A., 518
 Greenfield, P.M., 497
 Greer, B., 551
 Greitemeyer, T., 484, 487, 494
 Gremmen, H., 487, 492, 497
 Gretschell-Leiter, K., 541
 Gross, J.J., 70, 71
- Grounded theory
 case study, qualitative research, 183–184
 definition, 183
- Grunert, J.A., 378
 Guba, E.G., 138, 222
 Guerrera, C., 506

- Gulz, A., 759, 761
Gura, M., 583, 586
Gurung, R.A.R., 348
Gustafson, K.L., 78, 83, 84, 146, 317, 611, 652
Gutierrez, R., 575
Gutstein, E., 557–558
- H**
Haake, M., 761
Haanstra, F., 586
Haase, D., 747, 750
Habermas, J., 163, 164
Habgood, M.P.J., 726
Hafner, R., 465
Haig, K.M., 474
Hakkarainen, K., 441, 506
Hall, N.C., 469
Halloran, J., 157
Halpern, D.F., 278
Halverson, R., 258
Hamilton, L.S., 341
Hammer, M.R., 121, 616
Hampel, R., 642
Hamre, B.K., 896
Hamreus, D., 79
Hand V., 351
Hang, D., 156, 158
Hannafin, M.J., 34, 135, 504, 518, 519, 640, 644, 707
Harden, R.M., 860
Hardiman, P.T., 273
Hardre, P.L., 656
Hardy, J., 798
Hargroves, K., 563, 564
Harless, J.H., 40, 45
Harman, K., 784
Harré, R., 413
Harris, D.N., 240
Harris, J., 168, 842
Harris, M.B., 487, 492, 493
Hartley, K., 389
Hart, S.G., 484, 487
Hart, S.M., 147, 148
Hasselbring, T.S., 400
Hattie, J., 388, 413, 415
Hattie, J.A., 368
Havelock, R.G., 617
Hawkridge, D., 911
Hawley, D.E., 495
Hays, R.T., 497
HCIL. *See* Human Computer Interaction Lab (HCIL)
Head, A., 822
Healy, J., 114
Hearst, M., 793
Hechter, R., 168
Hedberg, J., 249
Hedrick, T.E., 248
Heinich, R., 607
Helsdingen, A., 784
Hemmeter, M.L., 597
Henderson, L., 407, 492, 497
Henderson, P., 420
Hendricks, C., 165, 166
Heritage, M., 336–337
Hernández-Leo, D., 444
Herring, S.C., 179
Herrington, J., 400, 401
Hesse-Biber, S., 223
Hesse, F.W., 12
Hess, K., 555
Hew, K.F., 175
Hickey, D.T., 832, 833
Hiebert, J., 473
Hiemstra, R., 362
Higgins, S.E., 691
Highly Integrated Model Assessment Technology and Tools (HIMATT)
application, 291–292
architecture, 290
core unit, 291
development, 290, 293, 294
functions, 290, 291
implementations, 291
measurements, 291
Hill, J., 640
Hillsman, T.L., 145, 147
Hilton, J. III., 783, 784
Hilton, M., 496
HIMATT. *See* Highly Integrated Model Assessment Technology and Tools (HIMATT)
Hinske, S., 704
Hinton, G.E., 466, 467
Historical inquiry, educational technology
description, 575–576
digital sources, 576–577
K12 students, 576
simulations and games, 577
student-centered usages, 576
Hmelo, C.E., 675
Hmelo-Silver, C.E., 644
Hodgkinson-Williams, C., 782
Hodgson, T., 465
Hofer, M., 168
Hoffman, B., 257, 895
Hoffman, R.R., 539
Hoffrage, U., 472
Hofstede, G., 350
Hofstein, A., 257
Ho, H.-K., 34
Holland, J., 471
Hollins, E.R., 348
Holmes, G., 652
Holt, J.E., 656
Holyoak, K.J., 471
Homegrown theories
definition, 553
Freirean approach, 557–558
instructional models and, 553
mathematics classroom activity, 556–557
Mathe 2000 project, 554–555
realistic mathematics education, 555–556
social and cultural contexts, 554
Honey, M.A., 496
Honey, P., 771
Hong, N.S., 268
Horkay, N., 595
Horz, H., 518, 521
Hoskins, S.L., 520
Hosman, L., 887
Houghton, H.A., 375
Howe, N., 818–820, 823
Hsiao, C., 353

- Hsu, Y.-C., 747, 749, 750
 Huang, Y.M., 715
 Hubal, R.C., 762
 Huet, N., 520, 521
 Huffstetter, M., 591
Human Computer Interaction Lab (HCIL), 181, 182
Human performance technology (HPT), ID
 cause analysis, 45
 “classical” analytical frameworks, 46
 commonalities, 40
 core processes, 44–45
 design thinking, 46
 emerging interdisciplinary field, 48
 ethics, 40
 evidence-based practices, 40
 formative, summative and confirmative evaluation, 40
 frameworks and methods, 40, 41
 idiosyncratic comparisons, 39
 intervention selection, 45
 measurement results, 46
 origins, 40
 performance analysis, 45
 practitioners, 39
 relationship, 39
 research base, 40, 42
 savvy instructional designer, 46–48
 systemic and systematic approaches, 40
 systems view, 42–43
 Hundhausen, C.D., 794
 Hundley, V., 251
 Hung, W-C., 144, 147–149, 269
 Hur, J.W., 842
 Hutchinson, C.S., 42
 Hutchinson, D., 595
 Hwang, G.-J., 774
 Hyle, A.E., 619
 Hylén, J., 780, 782
Hypothesis generation, inquiry learning
 scaffolding, 455
 scientific reasoning, 453
- I**
- IBL.** *See* Inquiry-based learning (IBL)
IBSTPI. *See* International Board for Training, Performance and Instruction (IBSTPI)
ICAI. *See* Intelligent computer-assisted instruction (ICAI)
ICT competencies
 definition, 322
 digital literacy, 322, 323
 literacy (*see* ICT literacy assessment)
 manipulation, software, 323
 professionals and nonprofessionals, 323
 Web-based translators, 322
ICT impact
 computers, 889
 and cost, 884
 economic, 889
 leveraging community, 887
 social, 885
 student learning, 890
 teacher and student practices, 889–890
 vision, 886
ICT literacy assessment
 computer, 322, 323
 digital, 322, 323
 information society, 322
 technology, 322–323
ICT policy, developing countries
 classrooms, 884–885
 economic development, 885
 education, 884
 multiple rationales, 886
 OLPC, 884
 perspective, 884
 and planning, 884
 programs and resources, 886–887
 reform, education, 885–886
 social progress, 885
 structure, 886
 UNESCO-report, 885
 vision, 886
ICT-related PCK. *See* ICT-related pedagogical content knowledge (ICT-related PCK)
ICT-related pedagogical content knowledge (ICT-related PCK), 102–103
ICTs. *See* Information and communication technologies (ICTs)
ICT-Simulation Assessment Software (ICT-SAS)
 academic/certification, 329
 benefits, 329
 certification, 329
 data-mining model, 329
 design, administration and workstations test, 329
 design tools, 329
 desktop environment, 330
 environment, 329
 hierarchical scheme, 329–330
 operating system and notepad, 331
 scoring pseudo code, 332–333
 scoring scheme, 332
 slide presentation, E-mail, internet and database, 331
 text processor, 331
 worksheet, 331, 332
ID. *See* Instructional design (ID)
IDI. *See* Instructional Development Institute (IDI)
IDT. *See* Instructional Design and Technology (IDT)
IES. *See* Institute of Education Sciences (IES)
 Ifenthaler, D., 476, 477
Immersive technologies
 commercial growth, 731
 design-based researchers, 731
 game-like fantasy environments, 725
 repetitive tasks, 727
 simulations, 724
 situated and constructivist, 725
 situated learning, 721
Individual and group differences, 866
Inducing support devices, 519
Informal learning
 assessment (*see* Assessment)
 definitions and dimensions, 256–257
 description, 255–256
 environments, 255
 framework, 257
 meaning, 256
 perspectives, 256
 recommendations, 262–263
 review, 256
 science (*see* Informal science education)
Informal science education
 eLearning, 257
 projects and programs, 257

- “strands of science learning”, NRC report, 257–258
success and effectiveness, 257
- Information and communication technologies (ICTs)
assessment
knowledge and skills, 323
measurement, digital literacy, 323–324
requirements (*see* Assessment standards, ICT)
software (*see* ICT-Simulation Assessment Software (ICT-SAS))
statistics report, 324
- competencies (*see* ICT competencies)
- description, 322
- developing countries
community engagement, 888
cost, 888–889
deploying, infrastructure, 887
descriptive reports, 889
electronics, 888
Intel’s Teach program, 884
maintenance and support, 887
and OLPC, 883–884
policies (*see* ICT policy, developing
countries)
research, 889
schools, 884
student learning, 890
teacher and student practices, 889–890
teacher training, 887–888
World Bank, 884
- development, individuals motivations, 321–322
- in education, 665
- evaluation
computer-assisted presentations, 325
CVT, 324
data management, 325
definition, 324
Electronic mail (E-mail) management, 325
environment, 325
human aspects, 325
image handling, 325–326
information technologies, 326
organizing folders and files, 325
spreadsheet, 325
standards, technological literacy, 324–325
syllabus, 325
taxonomies, 324
text processing, 325
verbs and verb phrases, 324
- instructional design process, 660
- learning platforms, 663
- online test (*see* Online testing, ICT)
- Information processing theory
implications, 25
instruction, 25
learners, 25
long-term memory, 25
psychology, 25
sensory register, 25
short-term memory, 25
- Information visualization
data attributes/types, 790
human interaction, 790
research, 789
taxonomies, 791
- Innovative technologies, 865
- Inquiry-based learning (IBL), 93
- Inquiry learning
description, 451
educational studies, scaffolding (*see* Scaffolding, inquiry learning)
evidence-based design, software scaffolds, 452
meta-analytical findings, 452
presence, learner support, 452
project-based science classrooms, 452
psychological research, scientific reasoning (*see* Scientific
reasoning, inquiry learning)
scientific reasoning skills, 451
software development (*see* Learning environment)
- Institute of Education Sciences (IES), 636
- Instruction. *See* Instructional design (ID)
- Instructional and non-instructional products, 142
- Instructional communications system, 374, 375
- Instructional design (ID), 861
assumptions, 78–79
authoring tools and languages, 660–661
A-V movement, 607
Briggs, 608–609
categories, 84
characteristics, 84
comprehensive collection, 84
conceptual tools, 80–82
CPP CTA method, 544
cybernetic iteration, 611
description, 78, 605
design models, 610–611
development, 78
elearning standards (*see* eLearning standards)
emerging models, design, 608
expert systems and automated/guided ID, 661–663
guided training, 545–547
Gustafson’s classification factors, 83
high-level processes, 610
and HPT (*see* Human performance technology (HPT), ID)
human learning, 77
ICT and, 660
individual to distributed, 667
information-based to knowledge model-based, 667
instructional design model, assumptions, 78
intended, 85
ISD, 78
and job aids, 661
latter type, 605
learning and teaching activities, 659
life cycle, learning environment, 660
micro-learning activities, 79
model creation and application, 610
models, 79–80
models proliferation, 609–610
operational tools, 82–83
paradigm, 84
“plans”, 606
professionalization and finn, 607
research, 546
revised taxonomy, 84
in 2000s
CALL (*see* Computer-assisted language learning
environments (CALL))
conceptual learning, 92–93
content creation, 90
development, 96
educational market, 94
Four Ages of Educational Technology, 89
game-based learning, 94–95

- Instructional design (ID) (*cont.*)
- K-12 students, 93
 - learning environments, 89–92
 - learning sciences, 93
 - and learning taxonomies, 90
 - message design, 90–91
 - minicomputers, 94
 - PBL, 93
 - rudimentary, 90
 - simulation, 91
 - systematized models and theories, 89
 - task analysis, 90
 - technology, 90
 - situations, 84, 85
 - social/semantic web environments, 664–665
 - strategy components, 659
 - supporting instructional design, 666–667
 - systematic approach to delivering programmed, 78
 - “systematic method for designers”, 608
 - systems approach, emergence, 609
 - systems approach, origins, 609
 - taxonomy, 83–85
 - teaching and learning, 78, 79
 - teaching machines and programmed learning, 607–608
 - theory and educational practice, 659
 - tutoring to open learning design, 665–666
 - Tyler and eight-year studies, 606–607
 - typical journal article, 85
 - validation, 85
 - Visscher-Voerman’s intent, 83–84
 - VW
 - design and development, 728
 - design-based research, 729–731
 - popular companies, 728
 - simulations, 728
 - strategies, 728, 729
 - Unity 3D*, 729
- Instructional design and technology (IDT). *See also* Instructional systems design
- design and development research, 142
 - online learning, 148
- Instructional designer, 39
- Instructional Development Institute (IDI), 79
- Instructional development, systems approach, 607
- Instructional engineering
- face designers, 666
 - support designers, 668
- Instructional message design
- assumption, 374
 - communications theory
 - behaviorism, 373
 - human information-processing, 374
 - interaction, 373
 - learning theory, 373
 - teaching-learning problems, 372
 - transmission, 372–373
 - compilations, 374
 - content, strategies and control, 377
 - conversation, 377, 378
 - definitional problems, 375
 - description, 372
 - design, 371
 - devise technologies, 371–372
 - differentiation, 379
 - exposure, 372
 - framework, 376–377
- media attribution, 375–376
- media-logic and data management, 377
- metaphor, 376
- methodology, 376
- multimedia learning, 372
- philosophical mismatch, 374–375
- process, 377
- representation, 377
- research paradigm, 378
- syntheses, generalized principles, 375
- systems philosophy, 376
- technology-facilitated environments, 377
- traditional, 372
- Instructional scaffolding
- computer/paper-based (*see* Computer/paper-based scaffolding)
 - consciousness and higher order thinking, 504
 - definition, 503–504
 - description, modalities, 505
 - design theory, 511
 - domain-specific knowledge, 512
 - dynamic assessment and fading, 511–512
 - educational technology and learning sciences, 503
 - factors, influence students’ reception, 505
 - goals, theoretical foundations, 504
 - mechanisms, 505
 - meta-design guidelines, 510–511
 - one-to-one (*see* One-to-one scaffolding)
 - one-to-one vs. computer-based scaffolding, 513
 - peer (*see* Peer scaffolding)
 - process, parents helping infants, 504
 - researchers, meta-analysis, 513
 - transfer of responsibility, 512–513
 - ZPDs, 504
- Instructional strategies, 347, 355
- Instructional systems design (ISD) model, 78, 119, 143, 144
- academic titles, 609
 - description, 893
 - implementation, 894
 - materials and programs, 893
 - MI theory, 146
 - teacher (*see* Teacher education)
 - and technology, classrooms (*see* Classroom design and technology)
- Instructional Systems Development (ISD) model
- definition, 42
 - and HPT, 42
- Instructional technology
- ethical issues, 843–844
 - professional development, 842–843
- Intelligent computer-assisted instruction (ICAI), 10, 12
- Intelligent tutoring systems (ITSs), 10, 758
- affect recognition, 428
 - agent-based, 428
 - description, 426–427
 - knowledge-based (*see* Knowledge-based ITSs)
- Interactive spaces
- devices and displays, 693–694
 - keyboard and mouse, 687–688
 - and surfaces (*see* Interactive surfaces)
- Interactive surfaces
- ACM conference, 688
 - CSCL, 695
 - direct input, 694
 - educational practice, 696
 - educational research, 696
 - foundational hardware, 688

- IWBs (*see* Interactive whiteboards (IWBs))
kinesthetic learning, 695–696
multiple access points, 694–695
natural user interfaces, 688
revolutions, 688
tablettops (*see* Interactive tablettops)
tangibles, interfaces, 589
ubiquitous computing, 688
- Interactive tablettops
commercial systems, 691
description, 690
horizontal orientation, 691
Microsoft surface, 691
operating systems, 691
touch-based, 691–693
- Interactive whiteboards (IWBs), 690
- Internal validity
application, 33
background selections, 33
color filters, 33
contextual support, 34
elementary school students, 33
legibility, 33
nonsense and real words, 33
standardized letters, 33
stimulus materials, 32
study learning, 34
typical classroom, 33
- International Board for Training, Performance and Instruction (IBSTPI), 651
- The International Society for Performance Improvement (ISPI), 116
- International Society for Technology in Education (ISTE), 636, 651, 824, 828
and NAEA, 583
national visual arts standards, 583
- International technology transfer (ITT), 632–633
- Interpretive tradition, 176, 178
- Ioannidou, A., 533
- Ionas, I.G., 280
- Irgens, E.J., 618, 619
- ISD. *See* Instructional Systems Design (ISD)
- ISD model. *See* Instructional Systems Development (ISD) model
- Ishii, H., 688, 689, 704, 708
- ISPI. *See* The International Society for Performance Improvement (ISPI)
- Issacs, S., 884
- Issenberg, S., 858
- ISTE. *See* International Society for Technology in Education (ISTE)
- Ito, M., 349
- Itow, R.C., 832, 833
- ITSSs. *See* Intelligent tutoring systems (ITSSs)
- Ivins, T.Z., 784
- IWBs. *See* Interactive whiteboards (IWBs)
- J**
- Jabri, M., 622
- Jackson, G.T., 492, 763
- Jackson, K., 222, 228, 229, 557
- Jacobson, M.J., 471
- Jacques, P.H., 404
- Jadallah, M., 506, 507
- Jahnke, I., 441
- Jameson, A., 57
- Jamison, D.T., 241
- Januszewski, A., 375
- Jehan, T., 704
- Jenkins, H., 577
- Jenkins, J.M., 92
- Jenlink, P.M., 616
- Jermann, P., 797–798
- Jesiek, B.K., 567
- Jia, B., 772
- Jiang, L., 519, 521
- jMAP, learners' representations, 290, 293, 294
- Johansen, J., 782–784
- John, J., 453
- Johnson, D., 438
- Johnson, L., 541
- Johnson-Laird, P.N., 465, 466, 468, 470, 471, 475, 476
- Johnson, M., 420
- Johnson, R., 438
- Johnson, S., 465
- Johnson, T., 477
- Johnston, L., 228, 229
- Johnston, M., 168
- Jonassen, D.H., 14, 46, 155, 268, 269, 278, 280, 284, 374, 375, 406, 474, 506, 511, 645, 771
- Jones, G., 812
- Jones, J.C., 610
- Jones, S., 415
- Jordan, C.M., 204
- Jossberger, H., 362
- Jukes, I., 827
- Jurica, J., 577
- Jutice, L.M., 506
- K**
- Kabilan, M.K., 747, 750, 753
- Kadah, M.M., 633
- Kafai, Y.B., 730
- Kahn, H., 277
- Kahn, S., 729
- Kali, Y., 510, 511
- Kalk, D., 84, 257
- Kalyuga, S., 497
- Kalz, M., 783
- Kamakura, W., 217
- Kamill, M.L., 496
- Kanter, S., 858, 859
- Kantor, R.J., 405
- Kaptelinin, V., 153, 154
- Karahalios, K., 797
- Kara, N., 704, 705
- Karasavvidis, I., 751
- Kardash, C.M., 277
- Karle, J.W., 487, 491
- K-20 AR literature review
affordances, 737
design, 738–739
development platforms, 739–742
limitations, 737–738
- Kato, P.M., 484, 488
- Katsionis, G., 490
- Kaufman, R., 43, 116, 121, 123, 124
- Kaye, D., 497
- KCR. *See* Knowledge of correct response (KCR)
- Kearney, W.S., 620
- Keefe, J.W., 92
- Ke, F., 488, 494
- Keller, F.S., 424

- Keller, J.M., 70, 71
 Kelle, U., 223
 Kellogg, W.K., 251
 Kelly, A.E., 552
 Kelsey, K.D., 751
 Kemmis, S., 163
 Kennedy, G., 823
 Kerawalla, L., 751
 Kerr, S.T., 653, 899
 Kershner, R., 439
 Ketelhut, D.J., 529, 729
 Khalfan, A., 354
 Khandelwal, M., 694
 Khan, F.A., 773
 Kicken, W., 363, 366
 Kilpatrick, H., 497
 Kilpatrick, J., 552, 554
 Kim, B., 104, 511, 708
 Kim, C., 70, 71, 758, 763
 Kincheloe, J., 164
 Kindon, S., 167, 168
 Kinesthetic learning
 colocated collaboration, 695
 learning experience, 695
 spatial memory, 695–696
 King, C.G. Jr., 843
 Kintsch, E., 290
 Kintsch, W., 10
 Kinzer, C.K., 400
 Kirkley, J., 498
 Kirkley, S.E., 498
 Kirkpatrick, D.L., 859
 Kirk, R., 251
 Kirschner, P.A., 406, 497, 652, 795
 Klahr, D., 452, 455
 Kleinbölting, H., 472
 Klein, G., 472
 Klein, J.D., 85, 133, 143, 372
 Klemes, J., 492
 Klerkx, J., 791
 Klopfer, E., 137, 643
 Kluger, A., 415
 Knezek, G., 204, 207, 216, 828
 Knotts, G., 407
 Knowledge-based design
 domain, 667
 learning and instruction, 667
 Knowledge-based ITSs
 constraint-based tutors, 427
 description, 427
 example-tracing tutors, 427–428
 model-tracing cognitive tutors, 427
 Knowledge diagnosis
 of mental models, 477
 Knowledge of correct response (KCR), 36
 Knowledge representation, model-based tools
 AKOVIA (*see* Automated Knowledge Visualization and Assessment (AKOVIA))
 ALA-reader (*see* ALA-reader, knowledge representation)
 analysis, 293
 artifacts, 293
 association and causality networks, 293
 automation, 295–296
 description, 287–288
 designing and development, learning environments, 287
 development, 293, 294
 disconnection, research and tools development, 295, 296
 exploration, 296
 functions, 288
 graphical forms, externalization, 288–289
 hardware and software technology, 289
 HIMATT (*see* Highly integrated model assessment technology and tools (HIMATT))
 ICT, 287
 implementation, 296–297
 internal, 288, 289
 interpretation, 289
 jMAP, 290
 open cross-validation, 296
 outdated tools, 295
 pathfinder, 289
 properties and strengths, 293
 quality, 296
 requirements, 287
 scientific quality, 293, 295
 standard assessment, 289
 testing, 295
 triangulation, 297
 types, 288
 Knowles, M.S., 361, 363
 Koedinger, K.R., 312, 428, 504, 809
 Koehler, M.J., 102, 104, 105, 845, 910
 Köhler, W., 465
 Kohl, P.B., 809
 Kolbe, K., 124
 Kollöffel, B., 810
 Kolodner, J.L., 506, 508
 Koohang, A., 784
 Kopcha, T.J., 843
 Korat, O., 593, 715
 Korn, R., 261
 Ko, S., 261
 Koszalka, T., 854
 Kozlowski, S.W.J., 363
 Kozma, R., 6, 811–812, 885, 889, 890
 Kraiger, K., 40
 Krajcik, J.S., 352, 452, 504, 512, 530
 Krems, J., 477
 Krippendorff, K., 376
 Krueger, A.B., 240, 242
 Krug, D.H., 584
 Kruger, R., 844
 Kuhl, J., 469
 Kuhn, D., 454, 455, 644
 Kuhn, T.H., 23
 Ku, H.Y., 354
 Kulhavy, R., 414
 Kumar, D., 250
 Kumpulainen, K., 349
 Kupritz, V.W., 145, 147
 Kuutti, K., 153
 Kuzma, J., 125
 Kvavik, R.B., 821
 Kwon, E.J., 833
 Kwon, H.I., 268
- L**
 Lacey, T.A., 831
 Ladd, H.F., 841
 Ladyshevsky, R.K., 747
 Laffey, J.M., 375, 488, 492

- Lagemann, E.C., 132, 163
Lajoie, S.P., 506
Lalingkar, A., 792
Lamb, A., 403
Lambur, M., 251
Lam, J., 418, 419
Lampe, M., 704
Lampert, M., 177
Lampert, N., 584
LAMS. *See* Learning activity management system (LAMS)
Lancaster, L.C., 818
Landry, S., 597
Land, S.M., 504, 518, 642, 645
Lane, A., 782, 784, 785
Lane, N.E., 305, 306
Lane, S., 620
Langdon, D., 43
Langley, A., 618
Lanzilotti, R., 492
Larivée, J., 519, 521
Larkin, J.H., 808
Larsen, A.K., 854
Larson, M.B., 652, 654
Lauber, B.A., 497
Laurel, B., 134, 726
Lavigne, N.C., 506
Lavy, J., 240, 242–243
Lawless, K.A., 596
Law, N., 884
Lawson, B., 655, 656
Lazarinis, F., 426
Lazonder, A.W., 452
LB. *See* Location-based (LB)
Learner agency, 413
Learner modeling research. *See* User modeling (UM)
Learning
 culture (*see* Culture in learning)
 emotion and affect, 59
 intentional, 78
 micro/macro-learning activities, 79
 new trends, 85
 personal and covert cognitive activity, 79
 unintentional, 78
Learning ability
 advisory models, 365–366
 construction, 362
 description, 368
 FLEs (*see* Flexible learning environments (FLEs))
 SDL (*see* Self-direct learning (SDL))
 SRL (*see* Self-regulated learning (SRL))
Learning activity management system (LAMS), 912
Learning analytics
 tracking and analysis, activities, 798
 visualization techniques, 800
Learning design
 activities, 789
 analysis phase, instructional design, 800
 applications, 792
 bubble sort algorithm, 794
 CompendiumLD, 801
 design phase, 801
 educational resources, 791, 792
 evaluation studies, 800
 GISMO system, 798
 hierarchical classification, 791
 learner model, 799
 learning effects, 798
 line chart, 799
 London Pedagogy Planner, 801
 LORs, 791
 Mendeleev's periodic table, elements, 793
 Open Graphical Learning Modeler, 801, 802
 pedagogical approaches, 794
 self-assessment tools, 799
 self-reflection and awareness, 798
 social network analysis, 792, 796
 visualization techniques, 795
Learning environment
 ASPIRE, 457–458
 description, 456
 evolution readiness, 456–457
 SCY project (*see* Science created by you (SCY) project)
Learning management systems (LMSs), 146, 326, 769
Learning object repositories (LORs), 791
Learning opportunity, support devices
 compensating, 518–519
 inducing, 519
 scaffolding, 519
Learning styles
 accuracy, identification approaches, 771
 Bayesian networks, 771
 definitions, 771
 learning style models, 772
 mouse movement patterns, 772
Learning technology, 840, 841
Learning theories
 audiovisual movement, 4
 back-to-basics movement, 4
 behavioral learning theory, 4
 behaviorist, findings and principles, 12–13
 CAI, 4–5
 cognitivist, findings and principles, 13
 commercial organizations, 5
 education, cognitive orientation, 5
 evolutions, 5
 expectations function, 4
 intensive electronic networking and social media, 5
 intrinsic limitations, educational research, 5
 noncumulative characteristics, 12
 permanent changes, 5
 PLATO, 7
 pragmatic position, 5
 program computers, 5
 schools and educational institutions, 5
 science and technology, 5
 socio-constructivist, findings and principles, 14–15
 and technological tools, 9
 and technology, 6–7, 15
 Zeitgeist, 4
Learning through collaboration (LtC)
 affordance and desired learning, 753
 knowledge and affective nature of writing, 752–753
 knowledge construction and meaning negotiation, 751–752
 learning space, 754
 microblogging, 753–754
 mobile Web 2.0, 753
 shared goals, 752
 social and work space, 753
 video editing and production, 754
LeCompte, M.D., 222
Lee, C.B., 375
Lee, C.D., 352

- Leech, N.L., 184
 Lee, C.-S., 792
 Lee, H., 506, 509
 Lee, J.-H., 336–337, 405, 424, 497
 Lee, M.-D., 491
 Lee, R.L., 540
 Lee, V.R., 808
 Lee, Y., 288
 Lehman, S., 389
 Leinonen, T., 506
 Leontev, A.N., 152
 Lepper, M.R., 497, 706–708, 726
 Lesh, D., 553
 Lesh, R., 465, 478, 552
 Lesson planning
 autoethnography, 896
 design-based, 896
 discourse analysis, 895
 Hunter method, 894
 interpretive and cognitive shift, 895
 late 1970s, 894
 prescriptive theory, 896
 process–product research foundations,
 classroom, 894–895
 programs, 1990s, 894
 reexamination, 896
 1960s, 894
 Lester, H.A., 491
 Lester, P.M., 830
 Leutner, D., 488, 491, 497
 Levels of teaching innovation (LoTi), 840
 Levie, W.H., 372, 375
 Levin, D.E., 701
 Levine-Clark, M., 718
 Levin, H.M., 237, 242, 495
 Levin, J.R., 386
 Levstik, C.A., 571
 Levy, B., 591
 Levy, S.T., 531
 Lewins, A., 222, 223
 Lewis, S., 441
 Lewthwaite, B., 353
 Li, D.D., 506, 510
 Light, D., 889
 Lim, C.P., 156, 158, 506, 715
 Lim, O., 203
 Lincoln, Y.S., 138, 174, 175, 185, 222
 Linden, L., 240–242
 Linder, J.R., 493
 Lindsay, J., 643
 Lin, H., 751, 843
 Linn, M.C., 504, 506, 510, 511, 535
 Lin, P.H., 581
 Lin, T., 772
 Lipka, J., 351
 Lipsey, M.W., 251, 495
 Li, S.C., 847
 Li, T.-b., 634, 635
 Liu, C., 809
 Liu, M., 506, 519, 708
 Liu, O.L., 506
 Liu, T.-C., 771, 772
 Liu, X., 354, 530
 LMSs. *See* Learning management systems (LMSs)
 Loacker, G., 419
 Locascio, D., 576
 Location-based (LB)
 description, 740
 Hoppola Augmentation, 741
 relative proximity, 740
 7Scenes, 741
 TaleBlazer, 741
 Lockee, B.B., 654
 Lodree, A., 492
 Lofland, J., 222
 Logic model and program/project evaluation
 assessment, 196–197
 formative, 197–198
 implementation and impacts, 196, 197
 obligation, elevators, 197
 research, educational technology, 196
 responsibility, 197
 summative evaluation, 196, 198
 Lohr, D., 497
 Loizou, A.T., 809
 Lomax, R., 209
 Lorch, R.F., 455
 LORs. *See* Learning object repositories (LORs)
 LoTi. *See* Levels of teaching innovation (LoTi)
 Louwerse, M.M., 763
 LtC. *See* Learning through collaboration (LtC)
 Luchins, A.S., 23
 Luckin, R., 753
 Luehmann, A.L., 746–748, 751
 Luehmann, E.C., 895
 Luigi, D.-P., 405
 Lukacs, K., 620
 Luke, J.J., 262
 Lund, K., 440
 Luppicini, R., 377
 Lynch, P.J., 493
 Lynch, S., 352
 Lysne, K., 585
 Lytle, S.L., 162–164, 166, 169

M

- Mabbott, A., 426
 Macaruso, P., 593
 MacBride, R., 747, 748
 Macdonald, R.J., 842
 Macfarlane-Dick, D., 415
 Macgregor, S.K., 843
 Machin, S., 240
 MacKenzie, N., 779
 MacLean, M.S., 164, 166
 Maddux, C.D., 186
 Mager, R.F., 40, 42
 Magjuka, R.J., 354
 Ma, H., 844
 Maietta, R., 223
 Malhotra, B.A., 451, 454, 456
 Maloch, B., 506
 Malone, T.W., 497, 706–708
 Maloney, D.P., 271
 Mandl, H., 444, 522
 Marek, P., 520
 Margaryan, A., 155
 Marisiske, M., 268
 Marker, A., 43
 Markle, D., 609
 Markle, S.M., 78, 608

- Markman, A.B., 465
Marmarelli, T., 716
Marshall, G., 830
Marshall, S., 847
Marsh, J., 341
Martin, B., 426, 897
Martin, C.A., 818
Martin, J., 46
Martín, S., 774
Masnick, A.M., 454
Massive multiplayer online (MMO), 722
Massive Open Online Courses (MOOC's), 796
Mastumoto, D., 347
Mathematics education
 anthropological and psychological, 350
 and China, 350
 coherent and comprehensive picture, 552
 culture and learning, 350
 “declarations of independence”, 551–552
 design experiments, 559
 domain-independent theories, 551
 enrichment, methodologies, 552–553
 as field, 552
 Homegrown theories (*see* Homegrown theories)
 learner's cognitive abilities, 350
 length restrictions, 558
 outcomes data, learning, 350
 researchers and scholars, 551
 reviews, 350–351
 specificity and integrity, 558
Mather, R., 404
Maton, K., 823
Maupin, F.G., 546
Mauri, T., 442
Maxwell, J.A., 222
Mayer, R.E., 375, 376, 387, 390, 391, 475, 489, 491, 497, 910
Mayes, J., 909, 912, 914
Mayeske, G., 251
Mayher, J.S., 166
Mazalek, A., 694
Mazza, R., 798
MBI. *See* Modeling-based instruction (MBI)
McAndrew, P., 784
McCaslin, M., 644
McClelland, J.L., 466, 467
McCracken, W.M., 656
McCradden, M.T., 389
McCutcheon, G., 895
McDonald, J.K., 6
McDougall, D., 354
McEwan, P.J., 237, 495
McGaghie, W.C., 857
McGee, J., 858, 859
McGee, S., 268
McGonigal, J., 483
McGraw, T., 584
McGregor, H.A., 521
McKenney, S.E., 134, 135
McKenny, S.E., 250
McLaughlin, L., 619
McNamara, D., 492
McNeill, D., 442
McNeill, K.L., 512
McNiff, J., 165, 167
McShay, J., 865–867
McTaggart, R., 163, 167
McVee, M.B., 703
Meaney, T., 351
Means, B., 341
Media arts, scholars, 582
Medical education
 conceptual thoughts, 857
 description, 854
 educational technology articles classification, 2011 medical journals, 855, 856
 infrastructure literature, 858–859
 medical education library databases, 856
 open internet searches, 856
 research, educational technology uses and impact, 860
 scholarship, 854
 semantic networking tools, 857
 simulation, 855
 social media technologies, 857
 social sciences domains., 854
 support mechanism literature, 859
 technology resources, 859–860
 themes, conceptual thoughts and research, 860–861
Medical school reform
 adoption studies, 862
 broad understanding, 862
 educational technologies, 855
 educational technology in medical education, 855–861
 EMR, 854
 medical education, 854
 methodology, validation and measurement, 862
 mindset, 861
 preparing medical students, medical practice, 855
 readiness, 861
 support, 861
 technology integration, 861–862
Megowan-Romanowicz, C., 533, 812
Meister, G.R., 242
Meltzer, D.E., 808
Mendels, P., 704
Menon, V., 58
Mental models
 and accommodation, 468
 and assimilation, 467–468
 characteristics, 468
 cognitive functions of, 468
 pragmatic conceptions, 468
Mental representation
 children with advanced motor skills, 682
 cognition and restriction of learning, 14
 problem solving, 807
 schemas and coherent mental models, 464
Mercer, N., 439
Merriam, S.B., 182, 184
Merrienboer, J., 404
Merrill, D., 704
Merrill, M.D., 14, 43, 90, 522, 544, 545, 644
Merrill, M.M., 497
Mertzman, T., 506
Message. *See* Instructional message design
Mestre, J., 271
Metacognition, support device usage, 520
Meyer, B.J.F., 594
Meyers, N., 404
Michinov, E., 440
Michinov, N., 440
Miclea, M., 152
Microsoft Space Telescope project, 216

- Middleton, A., 404
 Mihalca, L., 152
 Milani, C., 798
 Miles, M., 223
 Militello, L.G., 539
The Millennial generation
 characteristics, 818
 digital natives, 820–823
 empirical research studies, 820
 optimistic perspectives, 819
 Miller, C., 764
 Miller, G.A., 26
 Mills, G., 166
 Minguillón, J., 783
 Minogue, J., 812
 Mishra, P., 102, 104, 845, 910
 Mislevy, R.J., 541
MI theory. *See* Multiple intelligence (MI) theory
 Mitrovic, A., 426, 428
 Miyake, T., 632
 Miyashita, K., 216
 Mizuno, S., 521
MMO. *See* Massive multiplayer online (MMO)
Mobile learning
 anytime-anywhere learning model, 94
 multiuser virtual environments, 93
 The Pocket School, 169
Model. *See* Technology-enhanced, modeling-based instruction (TMBI)
Model-based learning
 communicating knowledge, 473–474
 constructivist approaches
 cognitive architecture, 466–467
 description, 465
 explanations, knowledge and information, 465
 imagination, 466
 isomorphism, force fields and cognized world, 465
 mental model theory, 466
 Peirce's semiotics, 465
 educational research, 475
 functional and pragmatic approaches, 464
 intentional construction, 464
 learners' semantic sensitivity, 475
 learning-dependent progression, 476
 mental models and schemas (*see* Mental models)
 model building assessment and mental models, 476–477
 modeling activities, classroom, 474–475
 modeling and reciprocal emotions, 469–470
 models of world, mental models, 467
 pragmatic approaches
 accordance, functional intentionality, 464–465
 instructional psychology, 464
 mathematizing, 465
 reproduction and symbolic models, 464
 subject matter domains, 465
 predictions and decisions (*see* Decision making)
 properties, external situations, 464
 psychology and education, 463
 qualitative research methods, 475
 reasoning (*see* Reasoning models)
 representations, mental, 464
 schemas, interpretation network, 467
 self-organized discovery learning, 475–476
 subjective plausibility, complex world, 471
 subject-matter domains, 474
 subject-matter oriented, 474
 theories development, physics, 471
 for understanding, 475
 Model-based reasoning
 analogy models, 477
 cognitive operations, 466
Model-based teaching, mathematics and science education, 470
Model-based thinking
 computational habit-of-mind, 531, 532
 qualitative and quantitative modeling, 530
 system thinking (*see* System thinking)
 TMBI environments, 530
Modeling and reciprocal emotions
 accommodation and assimilation, 470
 applications, model-based learning, 470
 assimilation resistance, 469
 cognitive aspects, 469
 cognitive theory, affect, 469
 degrees, incongruity, 470
 epistemic curiosity and stimulus seeking, 469
 mood repair hypothesis, 470
 performance, 469–470
 positive and negative state, 470
 stateemotions, 469
Modeling-based instruction (MBI)
 collaborative learning, 533
 description, 527
 features, 527–528
 in physics education, 530
 traditional learning environments, 528
 Moersch, C., 840
 Mohan, L., 506
 Mohr, M., 164, 166
 Molecular Workbench model, electron transport chain, 531, 532
 Molenda, M., 40, 374, 375
 Molloy, E., 418
 Montgomery, K.C., 574
MOOC's. *See* Massive Open Online Courses (MOOC's)
 Moore, A., 429
 Moore, J., 492
 Moore, S.L., 117
 Morales, C., 209, 214
 Moreira, G., 634, 635
 Moreno, R., 488, 491, 492, 497, 762, 765, 809
 Morie, J., 405
 Morris B.A., 484
 Morris, B.J., 454
 Morrison, G.R., 35, 43, 165
 Morrison, H.C., 606
 Moser Opitz, E., 555
 Moses, A.R., 626
Motivation and emotions
 cognitive and physiological, 65–66
 cognitive processes and strategies, 66–67
 decision making, 67
 description, 67–68
 energy and matter, physics, 66
 learning and performance, 66
 mastery goal orientation, 66
 reciprocal effects, 68
 research, 65
 students, 65
 Motivation, support device usage, 520–521
 Motivation to learn, 72
 Mruck, K., 223
 Muijs, D., 489
 Mulder, F., 780
 Mulder, Y.G., 452, 453
 Müller, G.N., 555

- Multicultural education
digital learning systems, 866
emerging hardware technologies in digital education, 867
multicultural learners in electronic education, 866
pedagogical frameworks, 865
software paradigms in digital education, 867–868
technological learning solution, 866
- Multicultural learning
electronic education, 866
social media, 867
- Multimedia instruction
annotated diagram, car's braking system, 383, 384
boundary conditions, 394
cognitive theory, 386
communication, engineers and investors/artisans, 385
computer-based, 386
description, 383
in educational films, 385
evidence-based principles, 384
fostering, generative processing (*see* Generative processing)
instructional goals, 388, 393
learning, printed words and illustrations, 385
managing, essential processing (*see* Essential processing)
Orbis Pictus, 385
Paivio's dual coding theory and preliminary design principles, 386
phases, history, 384
principle, 383
reducing, extraneous processing (*see* Extraneous processing)
research-based theory, 393
science of learning (*see* Science of learning, multimedia instruction)
slides, narrated animation of car's braking system, 383–385
sources, research evidence, 388
on verbal media, 384
- Multimedia learning
cognitive theory, 386, 387
essential overload situation, 387–388
essential processing, 387
extraneous overload situation, 387, 388
generative processing, 387
generative underuse situation, 388
instructional designers, 387
three demands, learner's cognitive capacity during learning, 387
- Multiple intelligence (MI) theory, 146
- Multiple source comprehension
analysis and synthesis, 596
satisficers and selectors, 597
selecting sources assessment, 596
subject-matter, 596
- Multiuser virtual environment, 93
- Mumford, A., 771
- Munsie, S.D., 506
- Münsterberg, H., 132
- Muramatsu, B., 783
- Murphy, D., 374
- Murray, J.H., 726
- Murray, T., 429
- Mutegi, J.W., 353
- Mwanza, D., 155
- N**
- Nadolski, R.J., 367
- NAE. *See* National Academy of Engineering (NAE)
- Naps, T.L., 795
- Nardi, B., 153, 154
- Nariani, R., 714–716
- Nasir, N.S., 351
- Nass, C., 758
- Nathan, M.J., 809
- National Academy of Engineering (NAE), 680
- National Council for the Social Studies (NCSS), 571–572
- National Educational Technology Plan (NETP)
education professionals, 590
global society, 595
- National Educational Technology Standards for Students (NETS-S), 583
- Natural user interface
new systems, 688
standard conventions and guidelines, 688
- NCSS. *See* National Council for the Social Studies (NCSS)
- Needs assessment, program and project evaluation, 196–198
- Nelson, B.C., 729
- Nelson, D.W., 288
- Nelson, M., 619
- NetLogo model, global warming, 531, 532
- NETP. *See* National Educational Technology Plan (NETP)
- NETS-S. *See* National Educational Technology Standards for Students (NETS-S)
- Networked learning, CSCL, 438
- Networking and Information Technology Research and Development (NITRD), 636
- Neuroimaging
CLT (*see* Cognitive load theory (CLT))
cognitive function, 51
“critical periods”, 52
direct translation, research, 61
education and behavioral sciences, 52
educators, 60
epidemiology and actual practice, health care, 60
language and the “reading brain”
classic debates, literacy research and education focuses, 56
complementary pathways, 56
cytoarchitectural organization, 54, 55
description, 54
dual-route framework, 56
English readers, 55–56
ERP and fMRI, 54
Italian language, 55
learning, 54
occipital-temporal areas, 54
orthographic depth hypothesis, 56
sound discrimination, 54
learning (*see* Learning) NCATE, 61
“neuromyths”, 52, 60
neuroscience and education, 61
neuroscientists examine cognitive functions, 60
neurotechnologies
brain's electrical activity, 54
cerebral blood flow, changes, 52
chemical and electrical neural activity, 52
cognitive neuroscience, 54
EEG and ERPs (*see* Electroencephalography (EEG))
empirical research, 52
fMRI (*see* Functional magnetic resonance imaging (fMRI))
fNIRS (*see* Functional near-infrared spectroscopy (fNIRS))
physiological responses, 52
state-of-the-art research, 54
numeracy and “mathematical brain”, 56–57
problem solving, 58–59
real interdisciplinary research, 61
substantial government investments, 51–52
synapses, 51

- Neuroscience
 basic assumption, 52
 cognitive, 54, 57
 cognitive, affective and social, 60
 “critical periods”, 52
 direct translation, 61
 and education, 61
 educational, 59
 educators, 60
 empirical research, 52
 implications, 60
 membership, 52
 tasks, 59
 “working memory load”, 58
- Newby, T.J., 14
 Newmann, F.M., 403
 Newstetter, W., 656
 Ng, S., 350
 Nguyen, Q.T., 166
 Nicholls, J., 747, 748
 Nicol, D., 415
 Nielsen, H.D., 243
 Nielsen, J., 910
 Nievene, N., 144
 Nigam, M., 452
 Nisbett, R.E., 471
 NITRD. *See* Networking and Information Technology Research and Development (NITRD)
 Ni, Y., 350
 Njoo, M., 453, 455
 Noffke, S.E., 164
 Non-scaffolding instructional support
 domain-specific knowledge, 512
 dynamic assessment and fading, 511–512
 Norhaidah, S., 353
 Norman, D.A., 226, 473, 808
 Norman, H., 109
 Norris, S.P., 278
 Norton, P., 893
 Nulty, D., 404
 Nussbaum, E.M., 277
- O**
 Oblinger, D., 818, 821
 Oblinger, J., 818
 OCR. *See* Optical character reader (OCR)
 OCW. *See* Open courseware (OCW)
 O’Donnell, C., 251
 OER. *See* Open educational resources (OER)
 Ofeish, G.D., 608
 Oh, E., 137, 403, 404, 818
 Oh, S., 506
 Okagaki, L., 497
 Oliver, K., 504, 518
 Oliver, R., 400
 O’Loughlin, M., 454
 OLPC. *See* One Laptop per Child program (OLPC)
 Olson, B., 860
 Olympiou, G., 812
 O’Neil, H.F., 492, 497
 One Laptop per Child program (OLPC), 883–884, 888
 One-to-one scaffolding
 definition, 505–506
 in elementary schools
 instruction, various subjects, 507
 reading instruction, 506
 intersubjectivity and customization, 507
 in middle school, various subjects instruction, 507
 transfer of responsibility, 507
- Online testing, ICT
 CAT, 327
 description, 327
 environment, 327
 ETS, 329
 management module, 327, 328
 new techniques, 327
 sequence actions, 327
 testing module, 327, 328
 vendors management, 329
- Onwuegbuzie, A.J., 184
 Open courseware (OCW), 781
 Open educational resources (OER)
 commons-based peer production, 782
 course development process, 782
 creative licenses, 780–781
 definition, 779–780
 discovery problem, 783
 educational research, 785
 educational technology, 785
 financial benefits, 783
 institutional production, 782
 localization, 784
 nations and states, 785
 policy, 781
 quality problem, 784
 remix, 785
 structure, 783
 sustainability, 783–784
- Open learning environments. *See* Student-centered learning
 Optical character reader (OCR), 202
Orbis Pictus, multimedia instruction, 385
 Organizational change
 funneling process, 621
 sequential projects, 618
 shape and implement change, 621
 Organization for Economic Cooperation and Development (OECD), 830
 Ortega, J., 204
 Ortony, A., 270
 Osgood, R.E., 405
 Osguthorpe, R.T., 657
 Oswald, S., 484
 Ottenbreit-Leftwich, A.T., 845
 Over, D.E., 471
 Ozdemir, G., 353
 Ozgun-Koca, S.A., 104
 Özpolat, E., 771
- P**
 Paavola, S., 441
 Paivio, A., 386
 Palak, D., 845
 Palincsar, A.S., 506, 508
 Pallant, A., 533
 Paloff, R.M., 261
 Pane, J.F., 341
 Pangaro, P., 377
 Papaevripidou, M., 531
 Papert, S., 11, 583, 584, 877
 Paquette, G., 663
 PAR. *See* Participatory action research (PAR)
 Paredes, P., 772

- Park, O., 424
Park, S.W., 70, 71
Parrish, P.E., 378
Participation, CSCL
and acquisition metaphors, 441
collaborative activity, 443
and interactive multiway communication, 441
social view of learning, 441
Web 2.0 technologies, 441
Participatory action research (PAR), 167
Participatory geographic information system (PGIS), 169
Pask, G., 377
Pathfinder, 289, 293, 294
Patricia, C., 780
Patru, M., 828
Patton, M.Q., 222, 248, 249, 909
Paulson, A., 528
Pauschenwein, J., 754
Pavlov, I., 24
PBL. *See* Problem-based learning (PBL)
PCK. *See* Pedagogical content knowledge (PCK)
Pea, R.D., 511
Pedagogical agents
adaptability and versatility, 759–760
anthropomorphous virtual characters, 757
CASA, 758
CLT, 759
cognitive and sociocultural foci, 763
communicative relationship, 761
description, 757
development, 758
digital environments, 764
educational psychology literature, 765
empirical research, 763
learner's sociocultural needs, 760–761
learning and performance, 762–763
methodological focus, 763–764
persona effect, 761–762
realistic simulations, 760
social-cognitive theories, 758–759
student-centered inquiry, 764
verbal communication, 762
Pedagogical content knowledge (PCK)
description, 102
development, 107–108
ePCK, 103
ICT-related, 102–103
TPACK, 106–107
TPCK-W, 103–104
Pedersen, S., 506
Peer scaffolding
definition, 507
in elementary school, science instruction, 507–508
intersubjectivity, customization and transfer of responsibility, 508
in middle school
reading instruction, 508
science instruction, 508
in universities, 508
Peeters, B., 223
Pegler, C., 784
Peirce, C.S., 465
Pekrun, R., 68, 69, 71, 469
Pentimonti, J.M., 506
Peppler, K., 582
70 Percent Rule, CTA
automated and nonconscious procedures, 543
healthcare “experts”, 542
percent of knowledge, individual interviews, 543
percent of OC steps, trauma experts, 543
practitioners, 543
trauma procedures, 542
Performance appraisal, 302
Performance assessment
alternative, 302
appraisal, 302
authentic, 302
classrooms, 303
complex and ill-structured, 306–307
description, 307
designed tests, 303
design strategies, 307
early China, 301
education, 301
France and Italy, 301–302
knowledge and skill, 303
least 1950s, 302
measurement, 301
modern standards, 302–303
objective, 303
observations, 303
portfolio, 302
professional guidance, 303
rating techniques, 303
reliable and valid, 303
research and development, 306
simulation-based (*see* Simulation-based performance assessment)
since 1960s, 302
task, 302
Performance-based training, 47
Performance evaluation, 302
Performance task, 302
Periathiruvadi, S., 203
Perkins, D.N., 518, 519, 522
Perkins, K.K., 528
Perry, A., 715
Persico, D., 443
Personalized instruction
computer software, 845–846
educational software, 845
intelligent tutoring systems, 846
Personalized learning
adaptive and intelligent technologies, 424
AI (*see* Artificial intelligence (AI))
description, 424
EDM (*see* Educational data mining (EDM))
four-dimensional perspective, adaptive learning, 430, 431
structure, environment, 424
UM (*see* User modeling (UM))
Petersson, E., 706, 707
Petruglia, J., 405
Petrides, L., 785
Pfaffenberger, B., 222
Pfaffman, J.A., 753
Pfeifer, M., 205
PGIS. *See* Participatory geographic information system (PGIS)
Phelps, C.L., 859
Phenomenology
aims, 880
Cartesian dualism, 880
educational technology, 880
inquiry, 880
methodology, 880
novice computer users, 880
researchers, 880–881

- Philip, R., 747, 748
 Phillips, J.J., 495
 Philosophy of science
 characteristics, 876
 constructivist epistemology, 877–879
 description, 874
 educational technology research, 873
 phenomenology, 879–881
 postpositivist science, 875–876
 research, 874–875
 scientific inquiry, 876
 structure, 873–874
 Phyfe, L., 168
 Piaget, J., 4, 26, 28, 90, 467, 705–706, 708
 Piele, P.K., 495
 Pifarre, M., 506, 508
 Pinch, T.J., 122
 Pink, D.H., 92, 96
 Pinkwart, N., 854
 Pintrich, P.R., 520
 Pipe, P., 40, 42
 Piper, B., 704, 708
 Pirnay-Dummer, P., 879
 Plano Clark, V.L., 222
 Plantamura, P., 492
 PLATO. *See* Programmed logic for automatic teaching operation (PLATO)
 Plomp, T., 115, 885
 Podolefsky, N.S., 528
 Poldoja, H., 854
 Policy sociology, 909
 Pollock, B.H., 484
 Pomportsis, A., 425
 Ponserre, S., 497
 Poole, G., 859
 Popper, K., 875
 Portable network graphics (PNG), 291
 Portfolio assessment, 302
 Postpositivist science
 claim, 876
 elements, 875
 hypotheses, 875, 876
 inquiry, 875–876
 representation, 876
 Potters, J., 487, 497
 Powell, D.R., 597
 Power, M., 896
 Pozzi, F., 443
 Pratt, K., 261
 Precedent
 episodic memory, 654
 knowledge, 654
 Preckel, F., 469
 Prensky, M., 820, 822
 Preservice teachers
 classic ID models, 900
 classroom and instruction, 901
 instructional design, 897, 899
 lesson plans, 896
 novice–expert studies, 896
 online learning, 899, 900
 pedagogical knowledge, 897
 Preskill, H., 261
 Presmeg, N., 794
 Pressley, M., 506
 Price, S., 439, 702
 Prinz, W., 466
 Pritchard, R., 415
 Problem-based learning (PBL), 93
 epistemological variants, 639
 and IL, 644
 Problem-solving
 adaptive representations, 810–811
 assessment methods (*see* Assessment)
 cognitive activities, 268
 complexity, 269
 and discovery learning, classroom, 478
 3D representations, 811–812
 dynamic representations, 811
 external representation, 808
 format, external representation, 808–809
 human skills, 807
 internal problem representation, 807
 multiple connected representations, 810
 process/activity, 267
 reified objects, 812
 and representations, 807–808
 situation, 268
 structuredness, 268
 tasks, complex systems, 478
 technological environments, 812
 well-structured, 268
 workplace engineering, 268
 Problem-solving learning environments (PSLEs), 277
 Problem types. *See* Assessment
 Professional development
 accumulating evidence, 599
 in-service, 106, 107, 109
 internet-based reading, 598
 language and literacy development, 590–591
 multiple source comprehension (*see* Multiple source comprehension)
 national evaluation study, 599
 pre-service, 106, 109
 research, 102
 students (*see* Students, professional development)
 teacher education and teacher, 106
 teacher learning and effective practice, 597–598
 technological content knowledge, 103
 technologies, support students, 589–590
 technology and assessment (*see* Assessment)
 Professional ethics
 application, 121
 component, 121
 current literature, 118
 primary informant, 124
 Program and project evaluation
 assessment, 197–198
 confirmatory, 195–196
 description, 193–194
 district leadership, 197
 educational innovations, 194–195
 evaluation vs. research, 197
 implementation, 198
 logic models (*see* Logic model and program/project evaluation)
 recommendation and training, evaluator, 198
 representation, 195
 research, instruction and learning technology, 194
 student risk, 197
 theory of change, 198

- Program evaluation
development and innovations, 250–251
efficacy and replication, 251–252
exploratory, 249–250
federal agencies, 247–248
framework, 248–249
principles and standards, 248
and research, 248
scale-up, 252–253
single analytic approach, 248
structure, Doe and IES, 248
- Programmed logic for automatic teaching operation (PLATO), 7
- Przybylski, A.K., 726
- PSLEs. *See* Problem-solving learning environments (PSLEs)
- Psotka, J., 427
- Publishing and sharing, Web 2.0
electronic portfolios, 748
learning logs, 747–748
- Puntambekar, S., 506
- Q**
- QDA. *See* Qualitative Data Analysis (QDA)
- QDAS. *See* Qualitative Data Analysis Software (QDAS)
- QEDs. *See* Quasi-experimental design (QEDs)
- Qualitative and quantitative modeling, 530
- Qualitative Data Analysis (QDA)
claims, 231
cloud, 231
collection strategies, 221
complexity, 220
complex projects, 219–220
continuums, 220
coordination and communication, 221
description, 222
diversity, 230
formats, 220
management, 221–222
partial list, study characteristics, 220–221
polarizing discourse, 231
research (*see* Qualitative research methods)
scope, 221
standard toolbox, 230
tools, 219
twenty-first century, 229
types, 220
Web 2.0 and QDAS, 229–230
- Qualitative Data Analysis Software (QDAS)
common tools, 225–226
convergence, 225
definition, 224
development, initial explosion, 224–225
difficulties, adoption and transition, 227
early programs, 223–224
features, 224
functions, 224
“microcomputers”, 223
negotiation, 228–229
researchers, 227–228
“user experience”, 226–227
and Web 2.0 tools, 229–230
- Qualitative research methods
AECT Handbook, 173
case study (*see* Case study, qualitative research)
- communication and social group
analyzing discourse, 179
applications, ECT, 179
CMC and CSCL, 178–179
connectivism, 178
conversation analysis, 178
conversations to online discourse, 179
ECT journal article, 178
impacting expansion, 178
trends and issues, discourse studies, 179–180
- data organization, 222–223
- ECT (*see* Educational communications and technology (ECT))
- exploring, 223
- individual experience
interpretive tradition, 176
interpretivistic research, 176
narrative analysis, 176–177
phenomenographical approaches, 177
pygmalion effect, 176
sharing voices, 177
- integration, 222, 223
- interpretation and reflection, 223
- NTC approach, 222
- personal experience, 177–178
- political and implies value judgments, 174
- practitioner-focused research, 182
- QDA software program, 223
- qualitative approaches, 173–174
- researcher, 180–181
- terminology (*see* Terminology, qualitative research)
- Quantitative tools
analysis, 201
data acquisition (*see* Data acquisition)
data analysis (*see* Data analysis)
data visualization (*see* Data visualization)
information technology, 21st century, 206–207
processing power, PCs, 201
statistical data analysis systems, 207
- Quasi-experimental design (QEDs)
evaluation framework, 249
scale-up study, 251–253
- Quillen, I., 627
- Quinn, J., 85, 455, 655
- Quintana, C., 460, 504, 511
- R**
- Rabling, B., 244
- Ragan, T.J., 43
- Ramani, S., 792
- Ramirez, M.S., 782
- Ramo, S., 609
- Randel, J.M., 484
- Randolph, J.J., 175, 183, 185, 186
- Rao, N., 350
- Rao, S.S., 716, 717
- Raphael, L.M., 506
- Raudenbush, S.W., 894
- REAL. *See* Rich environment for active learning (REAL)
- Realistic mathematics education
“emergent modeling”, 556
- RME, 555–556
- Rea-Ramirez, M.A., 471
- Reas, C., 584

- Reasoning models
 construction, mental models, 471
 deductive, 471
 domains, 472
 inductive, 471–472
 internal analogous representation, 471
 probabilistic mental models, 472
 semantic/pragmatic approaches, 471
 structural similarities, 471
- Rebertson, I., 752
- Recognition primed decision (RPD) model, 472
- Reeves, B., 758
- Reeves, D.B., 338, 339
- Reeves, P.M., 402
- Reeves, T.C., 14, 131, 134, 135, 155, 249, 250, 400, 402, 708, 818
- Reid-Griffin, A., 899
- Reigeluth, C.M., 22
- Reimann, P., 442, 443
- Reimers, S., 472
- Reinking, D., 135
- Reiser, B.J., 505, 506, 511
- Reiser, R.A., 80, 898
- Reisslein, J., 440
- Reisslein, M., 440
- Reis, S.M., 403
- Remix, 785
- Renkl, A., 521
- Renshaw, P., 349
- Renzulli, J.S., 403
- Representation technologies. *See* Problem-solving
- Research
 based instructional perspectives
 AUC, 36
 AVCR, 31
 ETR&D, 31–32
 external validity (*see* External validity)
 feedback study, 36
 instructional technology research, 32
 internal validity (*see* Internal validity)
 KCR, 36
 participants, 36
 performance incentive, 36
 primary incentive, participants, 37
 readers, 32
 stimulus materials, 32, 36, 37
 change agency
 communication, 621–622
 leadership, change, 618–620
 visual arts education
 categories, 586
 compendia, 587
 electronic technologies, 586
 NAEA's committee, 586
- Research funding
 ARPA-ED, 629
 EETT/Ed-Tech, 626
 K-12 educational technology, 627
- Research methods, ICT. *See* Information and communication technologies (ICTs)
- Research paradigms, 874, 881
 different paradigms and perspectives, 28
 educational researchers, 28
 insight and understanding, 27
 instructional theories
 design theories, 22
 distinction, 22
- educational research, 23
 inquiry methods, 22
 and learning processes, 22
 “prescriptive” theories, 22
- learners, 28
 learning, 21–22
 Merrill’s work, 28
 methods and outcomes, relations, 27
 and perspectives on learning
 behaviorism and neo-behaviorism, 23–24
 cognitive resource theories, 26
 cultural-historical theory, 24–25
 developmental psychology, 24
 gestalt psychology, 23
 information processing theories, 25
 prevailing paradigms, 23
 reconciliation, 23
 scientific revolutions, 23
 social constructivist theories, 27
 symbolic cognitive theories, 25–26
- Piaget’s developmental psychology, 28
- researchers, open mind, 28
- researchers working, 27
- sound research, 27
- Research quality, terminology
 case study (*see* Case study, qualitative research)
 classification, 176
 definition, 174
 educational studies and ECT, 175–176
 naturalistic settings, 174
 qualitative analysis, 174
vs. quantitative research, 175
- Resnick, B., 251
- Resnick, L., 400
- Resnick, M., 702
- Ressler, W., 643
- Resta, P., 828
- Retalis, S., 426
- Return on investment (ROI), 495
- Reuse
 pedagogical and design assumptions, 785
 types, 785
- Rezmovic, E., 251
- Rheingold, H., 824
- Ribble, M.S., 824
- Richards, L., 221, 223
- Richardson, J.C., 506
- Richards, S., 166
- Richards, T., 221
- Rich environment for active learning (REAL), 93
- Richer, R.A., 376
- Richey, R.C., 85, 89, 133, 372
- Rick, J., 691
- Rieber, L.P., 404, 497, 655
- Rimm-Kaufman, S.E., 896
- Ringle, M., 716
- Riordan, T., 419
- Rivet, A.E., 352
- Roberts, S., 119
- Robinson, D.G., 47
- Robinson, J.C., 47
- Robinson, R.S., 161
- Roblyer, M.D., 585, 909
- Robottom, I., 353
- Robson, R., 663
- Rockley, A., 712

- Rodrigo, M.M.T., 489, 494
Rodríguez, M., 783
Rodríguez, P., 772
Roe, K., 489, 493
Rog, D.J., 248
Rogers, E.M., 616, 617
Rogers, P.C., 377
Rogers, Y., 702
Rogoff, B., 348
Rohrer-Murphy, L., 155, 417
ROI. *See* Return on investment (ROI)
Romero, C., 429, 430
Romiszowski, A.J., 84
Ronen, M., 489, 494
Rosa, R., 889
Rose, E., 898
Roselli, T., 492
Rosenberg, M.J., 42
Rosenfeld, S., 257
Rosenquest, B., 701
Rossen, S., 261
Rosser, J.C., 489, 491, 497
Rossett, A., 42, 257
Ross, G., 503, 504
Rossi, P., 495
Ross, J.A., 495
Ross, S.M., 35, 44, 151, 155, 165, 243, 244
Roth, P., 415
Rouse, C.E., 240, 242
Roussou, M., 702
Rowland, G., 376
Roytek, M.A., 146
RPD. *See* Recognition primed decision (RPD) model
Rubens, W., 506
Ruble, J., 585
Rubrics, problem solving assessment
 argumentation
 ability, 277
 coding, student interaction, 279, 280
 objective forms, 280
 reading and evaluation, students' essays, 278
 student, 277–278
 mental simulations, 277
 performance construction
 determination, 275–276
 elements, 274
 formula, 274
 instructional and assessment function, 274
 interactions, 276
 material properties, 276
 material selection, 276
 physics, 274–275
 policy analysis, 276–277
 relationships, 274
 students, 275
 skills and activities, 279
Rudnick, M., 251
Rueda, S.M., 486
Ruiz, J.G., 859
Rule, A., 403
Rumble, G., 238, 241, 244, 779
Rumelhart, D.E., 270, 466–468, 473
Rummler, G.A., 40, 43
Russ-Eft, D., 261
Russell, J., 811–812
Russell, M., 243, 244
Russell, T., 910
Ryan, A.M., 520
Ryle, G., 15
Ryokai, K., 703, 706, 707
Ryon, E., 442
Ryu, J., 762
- S**
- Saab, N., 506
Sadler, D., 415, 416, 419, 420
Saettler, L.P., 372, 911, 914
Sagafi-Nejad, T., 632
Sahin, I., 105
Sahrir, M., 143, 147, 149
Sainsbury, M., 596
Sakdavong, J.-C., 520
Salomon, G., 222
Salter, D., 418, 419
Salvende, G., 543
Salvendy, G., 543
Sancho-Vinuesa, T., 244
Sandars, J., 857
Sandoval, W.A., 506
Sangra, A., 847
Santiago, A., 890
Santoro, L., 593
SAS. *See* Statistical analysis system (SAS)
Savelsbergh, E.R., 530
Savenye, W.C., 161, 260, 261
Savery, J.R., 404, 405
Saye, J.W., 107, 506
Scaffolding, inquiry learning
 evidence evaluation, 456
 experimentation, 455–456
 hypothesis generation, 455
Scaffolding support devices, 519
Scardamalia, M., 441
Schauble, L., 453
Scheirer, M., 251
Scheiter, K., 811
Scheuren, F., 261
Schiaffino, S., 426, 771
Schichl, H., 470, 471
Schmid, R.F., 239
Schmidt, D.A., 105
Schneider, B., 251
Schneider, W., 540
Schnotz, W., 518, 521
Schoch, H.P., 714
Schoenfeld, A.H., 131
Schonau, D., 586
Schön, D.A., 163, 611, 655, 896
Schools, desktop manufacturing
 3D printing, 677
 fabrication hardware, 678
 fabrication software, 678–680
Schramm, C.E., 373
Schraw, G., 389
Schrire, S., 442
Schultheis, H., 57
Schulze, S., 453
Schulz-Zander, R., 205
Schutz, P., 70, 71
Schwandt, T.A., 229
Schwartz, D.L., 808

- Schwarz, B.B., 440
 Schwier, R.A., 654
 Schworm, S., 520
Science
 agency, 352
 analysis, culture and learning, 351
 equity, 351–352
 identity, 352
 international studies, 352–353
 worldviews, 353
Science created by you (SCY) project, 458–459
Science education. *See* Technology-enhanced, modeling-based instruction (TMBI)
Science of learning, multimedia instruction
 cognitive theory, multimedia, 386
 human information processing system, 386
 learner, message, 386
 learner's motivation, 387
 learning (*see* Multimedia learning)
 organizing images, pictorial model, 386–387
 organizing words, verbal model, 386
Science, Technology and Society (STS), 122, 123
Science, technology, engineering, and math (STEM), 133, 582
 engineering design, 675
 habits, engineering, 683
 K-8 students, 674
Scientific Discovery as Dual Search (SDDS) model, 452
Scientific inquiry
 constructivist epistemology, 879
 phenomenology, 880
 philosophy, 876
 postpositivist, 875–876
Scientific reasoning, inquiry learning
 evidence evaluation, 454–455
 experimentation, 453–454
 hypothesis generation, 453
 SDDS model, 452
SCOLEs. *See* Student-centered, open learning environments (SCOLEs)
SCOT. *See* Social construction of technology (SCOT)
 Scott, G., 495
 Screen, C., 262
 Scriven, M., 249
SCY. *See* Science created by you (SCY) project
SDDS. *See* Scientific Discovery as Dual Search (SDDS) model
SDL. *See* Self-direct learning (SDL)
 Searson, M., 828
 Seeling, P., 440
 Seel, N.M., 79, 287, 288, 467, 471, 474, 476, 477
 Seels, B., 89
 Sefton-Green, J., 256
Self-direct learning (SDL)
 and FLEs
 assessment, 364
 components, 364
 design, 364
 guiding, 364
 implementation, ISDL model, 364–365
 learning tasks, metadata, 365
 portfolio development, 365
 integrating support and guidance, 368
 learning ability, 362
 open learning environments, 640
SCOLEs (*see* Student-centered, open learning environments (SCOLEs))
 skills design and development, 368
Self, J., 429
Self-regulated learning (SRL)
 ability, 362–363
 and FLEs
 feedback, 368
 instructional interventions, 367
 modeling, 367–368
 process worksheets, 367
 prompts, 367
 skills, 368
Self-regulation
 feedback, learning, 414
 and self-monitoring, 419, 420
 Selter, C., 555
 Senge, P.M., 336, 478, 618
 Sergiovanni, T.J., 336
 Serious games, taxonomy, 496
SES. *See* Socio-economic status (SES)
 Sfard, A., 441
 Sfiri, A., 754
 Shadish, W., 248, 251, 252
 Shager, E.J., 166
 Shannon, C.E., 374, 376
 Shapira, P., 251
 Shapley, K.S., 841, 847
 Sharma, P., 747
 Shattuck, J., 250
 Shavelson, R.J., 895
 Shedden, J.M., 491
 Shelburne, W.A., 714
 Shen, J., 535
 Shen, M.H., 809
 Shepard, L., 260
 Shepperd, J.A., 715
 Shermis, M.D., 258, 260, 261
 Shernoff, D.J., 485
 Sherwood, R.D., 400
 Shiffrin, R.M., 374, 540
 Shinkfield, A., 249
 Shoffner, M., 747
 Shulman, L.E., 102–104
 Shulman, L.S., 896
 Shumacker, R., 209
 Shute, V.J., 260, 415, 426, 427, 495
 Siegel, M., 653
 Siemens, G., 725
 Sierpinska, A., 552
 Silk, E.M., 675
 Silver, C., 222, 223
 Silverman, D., 180
 Silverman, L.K., 771–773
 Silvern, L.C., 79
 Simon, H.A., 808
 Simonson, M., 258
 Simons, R., 506
 Simpson, G., 533
 Simpson, J.R., 59
 Sims, V.K., 489, 491, 497
Simulation-based performance assessment
 advantage, 305
 completeness, 306
 computing technologies, 304
 description, 304
 development, 304
 diagnosticity, 306
 digital simulators, 305

- human performance, 304
job performance, pilots, 305
measurement, 305
non-aviation, 306
reliability, 305
seperability, 306
training, 304–305
utility and cost benefit, 306
validity and sensitivity, 305
- Simulations
dental hygiene skills and behaviors, 542
immersive (*see* Immersive technologies)
spatial, 727
and VW, 722–725
- Sins, P.H.M., 530
- Situated cognition
authentic learning, 400
in formal educational settings, 401
and legitimate peripheral participation, 400
- Situated learning
immersive environments, 721
VW (*see* Virtual Worlds (VW))
- Situation awareness
and mental models, 472–473, 478
RPD model, 472
- Sitzmann, T., 492, 493, 497
- Sivin-Kachala, J., 207
- Skarmeta, A.G., 506
- Skinner, B.F., 24, 659
- Skovsmose, O., 557
- Slavin, R., 32
- Sless, D., 376, 378
- Smaldino, S., 258
- Smart, A., 146, 147, 149
- Smart, E.J., 728
- Smart toy
age-related options, 708
attitudes and responses, 705
categorization, 703
characteristics, 702–703
children's play, 701
as cognitive tools (*see* Cognitive tools)
developmental stages, children
concrete operations stage, 706
formal operations stage, 706
preoperational stage, 705–706
sensory-motor stage, 705
- elementary school students, 704
fantasy play and imagination, 704
farm animals, 704
infrared transmitter, 703
intrinsic motivation
challenge, 706
control, 707
curiosity, 707
fantasy, 707
- LCD screen, 704
linguistic expressions and storytelling, 704
- MIT Media Lab, 708
multitouch and tablet technology, 708
- RFID, 704
- StoryMat, 703
- story objects, 705
- technology-based, 701
- two-wheeled vehicle, 704
- Smith, E., 175
Smith, G.G., 593
Smith, K.M., 376, 606, 610, 651, 652, 655
Smith, M.S., 251, 563, 564, 784
Smith, N.L., 405
Smith, P.A., 620
Smith, P.L., 43
Smolensky, P., 466, 467
SNAPP. *See* Social networks adapting pedagogical practice (SNAPP)
- Snowberg, R., 33
- Snyder, S.L., 747, 750
- Social construction of technology (SCOT), 122
- Social constructivist theory, 556
application, 27
CSCL, 27
Gestalt psychology, 27
mapping software and spreadsheets, 27
Piaget's idea of constructivism, 27
popular educational formats, 27
- Social networks adapting pedagogical practice (SNAPP), 796
- Social responsibility, ethics
Age of Technology, 122–123
Barbour's model, 122
description, 121
design-oriented disciplines, 123
emphasis, 121–122
Kaufman's model, 122
planning, design and conation, 123–124
- Socio-economic status (SES), 823
- Sociotechnical interaction network (STIN), 155–156
- So, H.-J., 104
- Soller, A., 797–798
- Son, J.Y., 809
- Soo, K.-S., 95
- Spada, D., 772
- Sparrow, L., 125
- Sparrow, R., 125
- Spector, J.M., 92, 94, 241, 828
- Spicer, J.I., 489, 494
- Spires, H.A., 491
- Spiro, R., 646
- SPSS. *See* Statistical package for the social sciences (SPSS)
- Squire, K.D., 95, 131, 136, 137, 405, 497, 577, 643, 739
- Sriraman, B., 553
- SRL. *See* Self-regulated learning (SRL)
- Stadtler, M., 367
- Stahl, E., 520
- Stahl, G., 745
- Stake, R.E., 182, 183, 249
- Stamas, S., 79
- Stanley, J.C., 203
- Starratt, R.J., 336
- Statistical analysis system (SAS), 208
- Statistical package for the social sciences(SPSS), 211
- St.Clair, R.K., 609
- Stead, G., 857
- Stealth and formative assessment
action model, 315
average creation, 316
bayes net estimation, 315, 316
definition, 313–314
design instructional systems, 317
educational and psychological measurement, 313
elements, 314
framework, ECD, 314
implementation, 317

- Stealth and formative assessment (*cont.*)
 Oblivion, 314–315
 student-performance information, 313
 students' information, 317
 variables, 314
- Steen, L.A., 552
- STEM. *See* Science, technology, engineering, and math (STEM)
- Stenhouse, L., 162
- Stensaker, I., 618
- Stern, P., 895
- Sterns, P.N., 575
- Stevens, R.H., 59
- Stewart, J., 465
- Stewart, N., 472
- Stickler, U., 642
- Stiggins, R.J., 310
- Stillman, D., 818
- Stimulus materials
 design, 32, 37
 external validity (*see* External validity)
 internal validity (*see* Internal validity)
 selection, 36
- STIN. *See* Sociotechnical interaction network (STIN)
- Stock, W., 414
- Stokes, D., 132
- Stolterman, E., 653
- Stone, D.L., 46, 47
- Stott, H.P., 472
- St.Pierre, E., 222
- Sträfling, N., 763
- Straka, G.A., 256
- Strand-Cary, M., 455
- Stratford, J., 489
- Stratford, S.J., 530
- Strauss, W., 818–820
- Streetland, L., 556
- Strijbos, J.-W., 443
- Stringer, E.L., 162
- Strobel, J., 280
- Stroop, J.R., 491
- STS. *See* Science, Technology and Society (STS)
- Stuber-McEwen, D., 843
- Student-centered learning
 approaches and technologies, 640
 epistemological variants, 639
 open learning environments, 640
 SCOLEs (*see* Student-centered, open learning environments (SCOLEs))
- Student-centered, open learning environments (SCOLEs)
 anchored instruction framework, 642
 beliefs and dispositions, 641
 case against, 643–644
 case for, 644–645
 civilization III, 643
 cognitive demands, 646
 crystal island, 643
 description, 640
 environmental detectives, 643
 flat classroom, 643
 individual interests, 642
 individual learning needs, 639
 interpretations and explanations, 641
 Jasper series, 642
 knowledge and experience, 642
 knowledge forum, 642
 learning systems designers, 640
- lingering questions, 646
 metacognition, 645
 methods, 646
 multiple representations, 641
 plantation letters, 643
 prior knowledge and experience, 645
 scaffolding, 645
 understanding and meaning-making, 641
 and WISE, 642
- Student modeling
 adaptive systems, 771
 characteristics and contexts, 776
 learners' characteristics and/or needs, 770
 learning styles, 772
 methods, 770
- Students, professional development
 cohort 2 students, 592
 computer-based interventions, 593
 eighth grade classes, 595
ICON, 594
 literacy skills, 593
 national evaluation, 591, 592
 SAT-10, 592
 software packages, 591
 supplement teachers, 592
 supporting emergent literacy, 591
 teacher training, 592
TELE-web, 593–594
 text structure, 594
 treatment classes, 595
 tutoring inferences, 594
 web-based system, 594
 word recognition abilities, 593
- Student writing, assessment
 constructed responses, 595
 formative, 595–596
- Studio pedagogy
 instructional designers, 656
 limitations, 655
- Stuebing, K., 415
- Stufflebeam, D., 249
- Subrahmanyam, K., 497
- Suharwoto, G., 105
- Sullivan, H., 143
- Sullivan, M., 542
- Summative and formative assessment
 benefits, 311
 characterizes, 311, 312
 classroom activities, 311–312
 computer-based educational systems, 312–313
 educational purpose, 310–311
 learner-centered measurement, 311
 learning, 311
 progressive approach, 311
 scope, 311
 traditional approach, 311
- Summative evaluation
 assessment, 251
 condition, 251
 design, 253
vs. formative, 249
 innovation, 251
 objectives, 251
 program and project
 and formative evaluation, 195
 learning outcomes, 195

- logic model, 196, 197
measures, 198
nature, 195
program's efficacy, 249
Summerville, J., 899
Sumner, T., 792
Sunal, C.S., 575
Sung, Y.-T., 489, 491
Suppes, P., 5
Support device usage
 benefits, 518
 classification, 518
 compensating, 518–519
 guidance, learners' learning process, 518
 inducing, 519
 instructional effectiveness, 518
 learner related conditions, 519
 and learner variables, 521
 learning environments, 517
 learning tasks, 518
 metacognition, 520
 motivation, 520–521
 prior knowledge, 519–520
 research, learner variables, 519
 scaffolding, 519
Sutton, S., 474
Swaak, J., 497
Swain, J.D., 407
Swan, K., 576
Sweller, J., 387, 390, 406, 497, 910
Symbolic cognitive theory
 Cognitive Task Analysis, 26
 computer metaphor, 25
 instructional theory, 26
 learning environments, components, 26
 schema theory, 26
Symonds, J.E., 175
Symonds, K.W., 310
Synchronous online CSCL, 440
System change
 “organizational identity”, 618
 organizations and, 618
Systems approach
 emergence, 609
 instructional design process, 606
 instructional development, 607
 model creation and application, 610
 origins, 609
Systems philosophy, 376
System thinking
 CCI, 531, 533
 characteristics, 531
 NetLogo model, global warming, 531, 532
 TMBI environments, 531
- T**
Taitague, C., 496
Tally, B., 576
Tamim, R.M., 239
Tang, E., 634
Tangible artifacts
 problem-based learning environment, 749–750
 VoiceThread, 749
Tanji, T., 125
Tan, Y.H., 747, 748
Tapscott, D., 818
Tashakkori, A., 222
Tatar, D., 654
Taylor, E.V., 351
Taylor, P.H., 894
Taylor, R., 610
TCK. *See* Technological content knowledge (TCK)
Teachable agent, virtual characters, 763
Teacher education
 AECT, 897
 decision-making, 898
 functions, teacher, 893–894
 grant funding, 898
 ID instruction, USA, 898
 IDT programs, 897
 K-12 schools, 898
 and lesson planning (*see* Lesson planning)
 novice vs. expert planning, 896–897
 planning practices, 897–898
 preservice, 898
 school-level, 897
 stark contrast, 898
Teacher knowledge
 characterization, 102
 educational technology, 103
 ePCK, 103
 pedagogical, 102
 technology, 102
Teacher learning and effective practice
 guide instruction, 597–598
 technology and professional development, 597
Teaching
 instruction, 79
 organize, external events, 78
Technological content knowledge (TCK), 102, 105
Technological pedagogical content knowledge (TPACK)
 alternative approaches, 102
 bodies of knowledge, 102
 complex relations, knowledge, 102
 components, 102
 content representations, 108
 development, 106
 educational technologies, 847
 educational technology, 103
 ePCK, 103
 ICT-related PCK, 102–103
 in-service professional development programs, 106
 instructional decisions, 845
 instruments, 104
 interviews, 104
 knowledge of learners, 108
 observations, 105
 open-endedness and rapid rate, change, 109
 open-ended questionnaires, 104
 PCK (*see* Pedagogical content knowledge (PCK))
 pedagogically oriented systemic changes, 848
 performance assessments, 104
 professional development, 845
 professional development approaches, 102, 106
 reliability and validity measurement, 105–106
 research, 109
 researchers, 101–102
 self-report measures, 104
 teaching strategies/methods, 108
 technology integration framework, 847
 TPCK-W, 103–104
 TPK, 107
 ubiquitous availability, 101

- Technological pedagogical content knowledge-web (TPCK-W), 103–104
- Technologies
 adaptive representations, 810–811
 3D representations, 811–812
 dynamic representations, 811
 haptic experiences, 812
 and learning theories (*see* Learning theories)
 multiple connected representations, 810
 reified objects, 812
 visual arts
 advocates, 584
 artistic expression, 584
 art making, 584–585
 assessment, 585–586
 educators, 584
 instructional strategies, 584
 resources and expertise, 585
- Technology-enabled assessment, 846
- Technology-enhanced, modeling-based instruction (TMBI)
 collaborative learning (*see* Collaborative learning, TMBI)
 designing scaffolded, 534–535
 K-12 science instruction, 528
 MBI, 527–528
 model-based thinking (*see* Model-based thinking)
 MUVE, 529
 PhET simulations, 528
 River City curriculum, 529
 scientific models, 527
 students' self-exploration, 528
 wave interference model, 528, 529
- Technology integration
 change, systemic level, 847
 cognitive tools, 824
 courses, 107
 definition, 840–841
 educational research, 858
 federal education legislation, 840
 instructional technology, 840
 internet technologies, 823
 legislative mandates, 847
 medical curriculum, 857
 medical education reform, 854
 national initiatives, 862
 overenthusiastic impression, 847
 pedagogically sound integration practices, 845
 personalized instruction, 845–846
 quality and availability, 840
 student-centered pedagogies, 844
 technology-enabled assessment, 846
 traditional, 108
- Technology readiness
 adaptive testing, 835
 computer-based and adaptive testing, 831
 digital badging systems, 827
 digital bombardment., 827
 digital citizenship, 830
 digital literacy, 828
 effective communication, 830
 embedded assessment, 832, 835–836
 Google, 827
 ISTE, 828
 model-based assessment, 836
 motivation and engagement of the learner, 830
 multiple types, assessment, 832
 observation assessment, 831
 paper/pencil testing, 831
 performance assessment, 836
 performance-based assessment, 831
 portfolio assessment, 832
 problem-solving, 828
 Rubric, 831–832
 selecting and applying appropriate tools, 829–830
 self-assessment, 832
 student technology readiness and skills, 830–831
 suitability, NETS•S skill categories, 834
 teaching/learning and performance environment, 835
 technological society and economy, 828
 technology driver's licenses, 829
 technology literacy tests, 829
 TechYES, 832–833
 types of assessments, 834
- Technology transfer
 AUC, 633
 reexamination, 633
- Teddle, C.B., 222
- Teijlingen, E., 251
- Tennyson, R.D., 363
- TEQ. *See* Test Emotions Questionnaire (TEQ)
- Terminology, qualitative research
 classification, 176
 definition, 174
 educational studies and ECT, 175–176
 naturalistic settings, 174
 qualitative analysis, 174
 vs. quantitative research, 175
- Tesch, R., 222, 223
- Tessmer, M., 35, 655
- Test Emotions Questionnaire (TEQ), 71
- Textbooks
 and educational materials, 714
 glare-free screen, 713
 printed texts, 713
 school systems, 713
 success of, 716
- Thagard, P., 471
- Theory of change
 logic models, 196, 197
 personal learning, 198
 research literature, 198
- Thomas, D., 349
- Thomas, M.K., 136
- Thompson, E., 261
- Thompson, L., 354
- Thorn, C.A., 340
- Thornton, S.J., 572
- Tilfarlioglu, F., 635 (Special character G must be inserted)
- Tillander, M., 584
- Timperley, H., 368, 413, 415
- Tinelli, L., 746, 751
- Tingley, K., 898
- T.Knezek, G., 214
- TMBI. *See* Technology-enhanced, modeling-based instruction (TMBI)
- Tobias, S., 406, 484, 491, 497, 645
- Toczek-Capelle, M., 440
- Tofel-Grehl, C., 540
- Tolentino, L., 812
- Tomblin, S., 498
- Tomei, L.A., 324
- Tompsett, C., 915
- Tompson, G.H., 490
- Tondeur, J., 847

- Tortell, R., 405
Toulmin, S., 278, 279
Towle, G., 715
Toy
 children's play, 701
 description, 701
 electronic, 701
 smart (*see* Smart toy)
 technology-based, 701
TPACK. *See* Technological pedagogical content knowledge (TPACK)
TPCK-W. *See* Technological pedagogical content knowledge-web (TPCK-W)
Tracey, M.S., 146, 147
Tracey, M.W., 372
Training. *See* Applications of CTA, healthcare training
Transfer of learning
 Apache Strike Force, 484
 cognitive processes, 484
 instructions, 484
 nongame contexts, 484
 pro-social computer game, 484
 Space Fortress II computer game, 484
 young diabetic patients, 484
Transfer of responsibility
 actor-oriented and future learning perspective, 512–513
 generic scaffolds, 510
 multiple perspectives/disciplines, 512
 one-to-one scaffolding, 507
 peer scaffolding, 508
Transformative policy. *See* Transforming American education
Transforming American education
 ambitious plan, 629
 learning, technology, 627
 NEA, 631
 “states should” phrase, 629
Traxler, J., 844
Treffers, A., 555
Triantafillou, E., 425
Truong, M.S., 506
Tsai, C.-C., 353
Tsang, M.C., 242
Tschirgi, J.E., 453
Tseng, T., 683
Tu, C.-H., 747, 751
Tulgan, B., 818
Tuomi, I., 780
Twelker, P.A., 79, 610, 611
Twenge, J.M., 819, 820, 822, 825
Twenty-first century skills
 definition, 828
 educational technology
 civic education (*see* Civic education)
 classroom examination, 578
 component, 572
 historical inquiry (*see* Historical inquiry, educational technology)
 integrated approach, 572
 integration, teachers, 578
 knowledge, 572
 literature reviews, 572, 577–578
 NCSS, 571–572
 personal technology, 578
 social studies, 571, 572
 student usage, 572
European Commissions' TENCompetence project, 828
knowledge economy, 886
technology readiness., 836
Twining, P., 175
Tyler-Wood, T.L., 203, 214, 215
Tyson, C.A., 571
- U**
- UDL. *See* Universal design for learning (UDL)
Ullmer, B., 688, 689
Ulrich, D., 617
UM. *See* User modeling (UM)
UMD. *See* The University of Maryland (UMD)
Universal design for learning (UDL), 119
The University of Maryland (UMD), 181
Usability
 design elements, 715
 e-textbook, 715
User modeling (UM)
 description, 425
 domain/teaching strategy, 426
 ITSS, 426
 methods and techniques, 425–426
 researchers' preferences, 426
 self advice, OLMs, 426
 static/dynamic approaches, 425
Usha, H.S., 714
Uttal, D.H., 262
- V**
- Valanides, N., 107
Valdes-Corbeil, M.E., 715
Vallejo, M.A., 204
van Aalst, A., 506
van Aalst, J., 442
van den Akker, J., 83, 85, 131, 137, 144
van den Bos, B.P., 368
van den Heuvel-Panhuizen, M., 555
van de Pol, J., 506, 507
van der Meijden, H., 494
van der Meij, H., 811
van der Meij, J., 810
Vandewaetere, M., 427
Van de Wiel, M., 362
Van Dijk, D., 415
Van Heuvelen, A., 271
van Hooff, J.C., 520
van Hout-Wolters, B.H.A.M., 506, 530
van Joolingen, W.R., 452, 455, 456, 506, 530
Van Langenhove, L., 413
Van Merriënboer, J.J.G., 363
Varma, K., 506
Vaucelle, C., 704
Vavasseur, C.B., 843
Veenman, M.V.J., 454
Veermans, K., 456
Veletsianos, G., 758, 761, 763, 764
Velmahos, G.C., 541, 544
Ventura, S., 429, 430
Vermetten, Y., 367
Vermunt, J., 520
Verschaffel, L., 555
Versteegen, D., 653
Viau, R., 519, 521

- Video games, 493
 Vigdor, J.L., 841, 844
 Villachica, S.W., 46, 47, 652
 Virtual learning environments (VLEs), 326
 Virtual tutee system (VTS), 70
Virtual Worlds (VW)
 Avatar Anna Caruso, 722
 educational and simulations, 723
 growth and use, 724–725
 immersive technologies, 721–722
 instructional design, 728–731
 intentionality of design, 723–724
 learning affordances and limitations (*see* Affordances)
 and MMO, 722
 model-based environments, 722
 situated embodiment, 723
 situated learning, 721
 theoretical foundations, 725–726
 type and variety, 723
 video game, 722
 Whyville and *Minecraft*, 721
 Virvou, M., 490, 491, 497
 Visscher-Voerman, I., 83, 146, 652
 Visscher-Voerman, J.I.A., 83
 Visser, L., 143
 Visual arts. *See* Visual arts education
 Visual arts education
 communication, modern society, 581
 DBAE and STEM, 582
 definition, 582
 design and technology trends (*see* Design and technology trends, visual arts)
 educational research, 582
 research, 586–587
 school-based visual, 582
 technological innovations, 581
 technology (*see* Technologies)
 Visualization techniques
 application domains, 801
 collaborative learning, 795–798
 description, 790
 designing environments, learning processes, 800–801
 finding learning material, 791–793
 information visualization, 790–791
 maps and drawings, 789
 real-life settings, 802
 Reconstituted Ptolemy's world map, 789, 790
 (self-)reflection, learning process, 798–800
 subject matter, 793–795
 visual approaches, 802
 visualization techniques, 789
 Volman, M., 506
 Voogt, J., 828
 Vos, N., 490, 494
 Voss, A., 205
 Voss, D.R., 145, 147
 Vratulis, V., 747, 749, 752
 VTS. *See* Virtual tutee system (VTS)
 VW. *See* Virtual Worlds (VW)
 Vygotsky's model, 152
 Vygotsky, L.S., 24, 152, 519, 583
- Wallace, R., 520
 Wallace, S.R., 305
 Walling, D., 582
 Walls, R.T., 845
 Walsh, D.A., 493
 Walters, R.H., 494
 Wang, C.-Y., 405
 Wang, F., 135
 Wang, Q., 144, 147–149, 859
 Warburton, S., 729
 Ware, C., 789
 Warschauer, M., 119
 Wasser, J.D., 228
 Watter, S., 491
 Watts, D., 336
 Waycott, J., 714
 Wayman, J.C., 335, 337
 Weaver, W., 374, 376
Web 2.0
 affordances, 406–407
 authentic and meaningful contexts, 751
 authentic learning environments, 750
 collaborative tasks, 748–749
 community and teacher use, 143
 CSCL, 441
 description, 745
 development, 230
 distributed cognition, 746
 early stages, 229
 flexible communication and interaction, 746
 learning activities, 746
 LtC (*see* Learning through collaboration (LtC))
 multimedia capacity, 750
 publishing and sharing, 747–748
 and QDAS, 229–230
 qualitative research, 230
 research, 747
 situated cognition, 746
 sociocultural theory, 746
 support distributing cognition, 746
 tangible artifacts (*see* Tangible artifacts)
 tools, 230
 web-based applications, 745
 Web-based Inquiry Science Environment (WISE), 509, 534–535, 642
 Web-based learning environments
 IMS-LD, 664
 learners, 664
 platforms/authoring tools, 663
 Webster, P.H., 587
 Web 2.0 Technologies, CSCL, 441
 Wedman, J., 655
 Wehlage, G., 403
 Wei, J., 543
 Weinberger, A., 442, 444
 Weiser, M., 688, 693
 Weiss, C.H., 248
 Weiss, L., 497
 Weitzman, E., 223
 Weller, M., 914
 Wells, S., 159
 Wenger, E., 336
 Wenk, B., 780
 West, R.E., 491, 847
 Wetzel-Smith, S.K., 307
 Wetzel, C.D., 484
- W**
 Waddington, T., 405
 Wagner, B., 417
 Wagner, D., 889

- Wheeler, S., 747, 749, 752
Whitehead, B.V., 484
Whitehead, J., 165, 167
Whittington, J., 474
Whittle, A., 621
Whitworth, A., 158
Wieman, C.E., 528
Wiggins, 835
Wilensky, U., 531, 683
Wiley, D., 118, 780, 782–784, 784, 842
Wilhelm, O., 471
Wilhelm, P., 454
Willcockson, I.U., 859
William, R., 260
Williams, B.R., 617
Williams, M., 714
Williams, R., 487
Williams, S.M., 400
Willis, J.W., 186
Willow, D.M., 375
Wilson, J.I., 631
Wind, A.P., 496
Wing, J.M., 531
Winne, P., 414
Winn, W., 14, 89, 91–93
WISE. *See* Web-based Inquiry Science Environment (WISE)
Wise, A.F., 492
Wishart, J., 497
Wittgenstein, L., 465
Wittmann, E.C., 552–555
Wolcott, H.F., 183
Wolk, R.M., 634
Wong, A.F.L., 844
Wong, N.Y., 350
Wood, D., 503, 504
Woodward, H., 714, 718
Woo, H.L., 759
Woolf, B.P., 773
Wopereis, I., 367
WorldWide Telescope Project, 216
Wray, S., 363
Wright, B., 831
Wu, H., 811
Wulfeck, W.H., 307
Wu, Y., 747, 751, 854
- X**
- Xie, Y., 747–748
XO computer, OLPC, 884, 890
- Y**
- Yacef, K., 430
Yackel, E., 556
Yager, R.E., 259
Yamagata-Lynch, L.C., 153, 155
Yanez, E., 351
Yang, C.C., 375
Yang, M., 418, 419
Yates, K.A., 542–544
YCCI. *See* Young Children's Computer Inventory (YCCI)
Yeaman, A., 116
Yinger, R.J., 895
Yin, R.K., 138, 182, 183
Yorke, M., 416
Young, A., 898
Young Children's Computer Inventory (YCCI), 204
Youtie, J., 251
- Z**
- Zacharia, Z.C., 531
Zago, L., 57
Zahorik, J.A., 894
Zaltman, G., 617
Zaman, B., 689
Zeichner, K.M., 164, 363
Zemke, R., 610, 818
Zhang, B., 530
Zhang, J., 808
Zhang, M., 504
Zhang, Y., 899
Zhao, N., 354
Zimmerman, B.J., 363
Zimmerman, C., 452, 453
Zimmerman, E., 586
Zlotolow, S., 617
Zone of proximal development (ZPDs), 504, 505
Zorko, V., 747, 749, 751
ZPDs. *See* Zone of proximal development (ZPDs)
Zufferey, G., 692
Zvacek, S., 258