SUBJECT INDEX

Aalborg experiment, 200, 231
ABET, 3, 5, 6, 7, 22, 24, 25, 27, 31, 35, 69, 72, 177, 180, 189, 257, 321, 392, 402, 403, 404, 406, 448
Accommodators 130, 131
Accountability 3
Active learning, 43, 229, 317, 321
-defined, 323
-and teaching 331
-and PSI 368
Action research, 157, 396, 397, 409
Admission Procedures (see also Supply), 441 ff
-effects on schools, 446
-grades and performance (UK), 74
-high school performance, 453
Adult development (ch 4), 117
Adult learning (lifelong learning) 163, 164, 165
Advanced organizer, 374
Affective domain 41, 43, 45, 46, 165, 166, 167
-(see also Taxonomy of)
-interaction with cognitive domain, 167
Affinity groups, 325, 327, 328
Affordances, 400
Aha events, 155
AH 6 Test of Intelligence, 183
Aims (of education) (see Ch 1 and Ch 2)
-confusion of terminology about 10, 21, 25, 179
-determination of, 12
-and mission statements, 4
-screening of, 12, 15, 16, 179
-and teaching emotions, 5
A level – (See also Engineering Science), 25, 74, 75, 182, 183
-predictor of performance, 394, 395
Algorithmic tasks, 262
Alumni surveys of, 35ff, 256, 339
Alternative Uses Test (Guilford), 278
Alverno curriculum, 392
Amabile, process of creative thinking, 266, 267
American Association for Higher Education, 420
American College Testing program (ACT), 211
American Society for Engineering Education (ASEE) 5, 69
Analogue Reasoning, 203, 246, 252, 276, 277
Analysis (skill of) 26, 27, 40, 155, 229, 248, 255, 261, 262, 265
Approaches to Study Inventory 121
Assessment (see also examinations, self assessment)
-authentic, 404, 405
-using concept maps 105
-creativity, 265, 277, 278
-essays, 162, 429, 431
-evaluation 11, 12, 392, 393
-formative 11, 317, 404
-functions of in the curriculum, 11
-knowledge v understanding, 182
-laboratory practicals, 31, 32, 33, 368 ff
-and learning, 12, 209, 419
-and learning styles, 133
-meanings of, 392
-meta, 211
-misunderstandings of, 178
-movement, The, 61, 241
-multiple objective, 25, 26, 292
-multiple strategy, 16, 133, 140
-non traditional, 397, 405
-objectives (see educational )
-open book, 324
-oral skills, 423, 432, 434
-overloading by
-peer, 237, 342, 343
-by portfolios, 419 ff
-power test, 269
-project work, 234 ff
-rubrics, 32, 33
-self, 204, 206, 230, 249, 427 ff
-summative, 11, 404
-student involvement in, 235
-teamwork, 326
-terminology, (see confusion in)
-uses of, 391, 392
-validity of, 246
-variety in (see multiple strategy)
Assessment of Performance Unit, 443
Associative Group Discussion, 323
Assimilators 130 131
Attitude(s)
-of engineers at work, 28 ff
-requirements for change in, 459 ff
-attitudinal surveys, 406
-attrition (see non-completion, retention, wastage),
-and curriculum and teaching 444 ff
-in electrical and electronics in UK, 447
-mathematics and decision to enrol, 458
-orientation programs, 446, 448, 449
-pre-admission policies, 448
-and women, 446, 448
-Australian Institute of Engineers, 265
-Australian Vice-Chancellors Committee 121
-Authentic assessment, 405
-Behavioral objectives (see Ch’s 1 
& 2) 21
-non-behavioral 21
-Behavioural styles 135, 136
-Belbin Team Roles
-Questionnaire, 168, 329, 330
-Benchmarking/standards, 22, 402
-Biggs Study Process
-Questionnaire 121
-Bloom’s Taxonomy-( See Taxonomy of Educational Objectives).
-Bosworth Report 59
-Brainstorming, 271, 273, 274, 275
-and nominal group technique, 274
-Bridging courses (to engineering)
-British Steel Corporation, 41, 47, 48
-Business and Technician
-Education Council, 45
-Buzz groups, 323
-CAD, Learning with 128, 129, 133
-and learning styles,
-CAL, 183
-Capability, 210,
-Case study method (see Ch 14) 355 ff,
-achieving reality with, 354
-design of, 355, 358
-check list for design of, 358
-and homework, 356
-CAD, Learning with 128, 129, 133
-and learning styles,
-CAL, 183
-Capability, 210,
-Case study method (see Ch 14) 355 ff,
-achieving reality with, 354
-design of, 355, 358
-check list for design of, 358
-and homework, 356

-and teaching role, 345, 356, 357, 358
- and guided design, 248, 249, 250, 355
- teaching ethics, 68
Case study research, 395
Change (educational – see curriculum change)
- starting a new degree, 252
Chartered engineer (UK), 180, 188
Classroom assessment, 12, 193
Classroom Activities, 17, 24, 251, 409, 453
Questionnaire, 451
Classroom climate (see also instruction), 450, 451, 452
Classroom opinion Polls 72
Classroom research, 12, 193, 460
Cluster analysis 30, 31, 33, 34
Cognitive development (see intellectual development)
Cognitive dissonance (see dissonance), 72
Cognitive emotional state, 168, 169
Cognitive restructuring 125
Cognitive styles (see also learning styles)(Ch 5) 119
-cognitive styles analysis 119, 134, 143, 144
-and the engineering curriculum 144
Collaborative (negotiated) assessment, 430
College (as a community- see also learning communities)), 452
Colleges, experience of, 81, 160
Colleges of Advanced Technology, 71, 75, 222, 446
Collegiality, 191
Collier’s objectives for teaching in higher education, 41
Committee of Vice-Chancellors and Principals (CVCP), 391
Communication, 205, 401
- competencies in, 166, 251
- courses in, 205
- dialogue in work groups, 335
- resistance to programs in (English), 206
Communities of Learning, 452, 453, 454
Community Service Projects
Competence 22
- emotional, 169
- interpersonal, 169
Competencies, 205
Concepts (and Concept learning) (see Ch 4) 91 ff
- CAI 98
- clusters 103
- computer program design 91, 92
- curriculum design 100
- differences between experts and novices 91, 106, 108, 111, 112
- fuzzy 95, 98
- and metacognition, 95
misconceptions (misperceptions), 92 ff
(misperceptions) 92, 103, 233
-misperceptions in heat transfer 99
-misperceptions in mechanics 92, 94, 97
-misperceptions in transport phenomena, 92, 95, 97
-effects of computing and maths on, 92, 94
-embeddedness of, 94
-and lack of knowledge, 94
-key (see separate entry)
-and learning of principles, 91
- and meta cognitive skill, 95
-and problem solving, 95, 96
-and types of problem solver, 108
-qualitative and quantitative understanding, 94, 108, 114, 318
-syllabus design
-teaching of 91, 93, 96 ff, 108
-with analogies 99, 101
-with animation 99, 100
-with concept cartoons, 99
-with examples 96, 98, 99
-transfer of learning 91
Concept mapping 103 ff, 167
-definition of 103
-and learning 94, 103, 104, 106
-and lecture design 105, 108
-levels of (general and specific) 103, 104
Constructivism 57, 58 ff, 155, 189
-alternative theory for science teaching, 155
-and teaching 59, 60, 61, 62
-social construction of reality 58
Continuous assessment (see also coursework), 31, 32, 33, 391
Continuous Quality Improvement (CQI), 404
Controlled assignments (experiments), 32, 224
Convergent thinking (see also creativity), 123, 264, 265, 334
-in engineering design
Conversation analysis, 335
Cooperative (sandwich) courses 31
Cooperative learning (Ch 13, see also Groupwork, syndicates, teamwork)
-and affinity groups, 325, 327, 328
-assessment (evaluation of), 343
-and associative discussion groups, 323
-base groups, 323
-characteristics of, 326
-communication in, 326
-definition of, 324
-dialogues in, 335
-dysfunctional, 336
-v lecture method, 323
-and gender, 331, 336
-and grading, 344, 345
-group dynamics of, 334, 335
-group skills learnt, 323
-group synergy, 331
-and industrial reality, 325, 327, 328
-leadership in, 327
-and learning styles, 330 ff, 335
-in lectures 323
-membership mix, 327, 329 ff
-and motivation, 325
-(see peer evaluation)
-personality type, 327, 329 ff
-preparation for, 336, 338
-pseudo learning groups, 323
-and quality circles (TQM) 324
-roles in, 323, 324, 325, 329
-selection of groups for, 326, 327, 328
-size of 323, 332
-skill teams, 325
-structured by writing, 325, 326
Council for National Academic Awards (CNAAs), 369, 392
Council of Engineering Institutions (CEI) 37, 123, 285
Course Development Matrix, 11
Course Experience Questionnaire (CEQ) 121
Coursework, 31, 32, 33, 391
-assessment of, 32, 33 391
Creativity (see Ch. 11, 11
-and architectural students, 272
-and algorithmic tasks, 262
-Amabile’s model, 266, 267
-and assessment, 264, 269, 271, 277, 278, 279
-biological factors, 268
-and cognitive behaviour, 266, 268
-convergent thinking, 264, 265, 273
Curriculum-assessment—
instruction-learning process,
models (see Ch’s 1 and 2, and
curriculum paradigms) 66 ff
-complexity of 6, 7
-course design, 10, 11
-teachers role in 12
Curriculum change (see Ch 7),
177, 195
-developing new programs, 187,
188, 189, 190
-cultural press, 6, 16, 177 ff
-market demand, 183, 184
-models of, 193
-history of 16
-and institutional culture, 177,
186, 190, 191, 192, 194
-need for 16
-and organizational structure 4,
80, 81, 193
-persistence of the curriculum/
subjects (resistance to change),
180, 188, 190, 318
-and student characteristics, 180
-within subject areas, 180, 181,
182, 191
-in traditional models 10, 180,
188, 189, 190
-and teachers 10, 191, 193, 194
-transfer of ideas, 191
Curriculum design (see Ch 1) 10,
11
-philosophy and (chapter 3), 12,
15, 53 ff
-philosophical principles
(Chapters, 4, 5, and 6), 14
-sociology and (chapter 3), 12,
15, 73 ff
Curriculum designer (role of) 28
Curriculum integrated assessment
(see ability led)
Curriculum leadership (leaders)
(see preface), 179, 193, 194, 195
-levels of, 18, 461
-role of, 12, 191
Curriculum, negotiation of 60,
189
Curriculum overload 6, 10, 180,
181, 184, 190, 199, 203, 204, 243
Curriculum reform (in)
-mathematics, 182
-mechanics, 181
Curriculum paradigms (models)
-ability led, 210
-communication model, 179
-negotiated, 60, 189
-received, 179, 180, 185, 186,
195, 319
-reflexive, 60, 177, 188, 195
-restructuring, 177, 195
-rythmic (see Whitehead), 5
-spiral, 164, 186, 187, 194
-threaded, 188, 200

Debates/mock trials, 358, 359
Decision making (skill of)
Declarative knowledge, 103
Deep learning (processing-see Ch 5),
169, 322
Degree programs-changes in, 180
Delphi technique, 95, 409
Department of Education (UK)
Department of Employment (UK)
28
Design (see engineering design
and Ch 12),
-childrens approaches to, 300,
301, 302
-definition of, 299, 300
-guided, 248, 249, 250, 332 ff
-Koen’s behavioural approach,
304, 305
-as a learned activity 129, 130
-models of design process, 304,
305
-Perkin’s theory of knowledge,
285, 295, 299 ff
-problem solving, 307 ff
-short courses in, 302
-social process of, 338
-and the Taxonomy 26
-and teaching, 284, 285
-types in relation to creativity,
355
Design office, 285
Design and Technology
Education (Schools see school
technology), 262, 301, 302
Design studio in engineering,
290, 291
Diagnosis (skill of) 31, 309
Diagnostic test 75
Diaries, 415
Discussion (focused), 378
Discovery (enquiry) learning.
163, 373, 374, 375
Dissonance (cognitive
dissonance), 154
Distance learning, 163
Divergent thinking, 334
Draw a Person Test 39
Drop-out (see attrition, non-
compleation, retention, wastage)
Dunn and Dunn’s learning style
theory
Education (see Aims of)
-as indoctrination, 153
Educational objectives (see
objectives)
Educational research, 193
Effective teaching (See teaching)
Electrical and Electronic Manufacturers Joint Education Board (UK)
Elementary (primary) education, lessons from, 163, 164, 165, 446
Embedded Figures Test (GEFT) (See Group Embedded)
Inventory, 168
Emotional Intelligence, 165, 166, 167
Empathy, 166
Empiricism, 54
Employment market, 184, 185, 186, 189,
Employment Department (UK) 3, 418
Engineer in Society course, 206
Engineering,
- Languages of, 185, 252, 253
- Multidisciplinary nature of, 185, 463
Engineering Council (see also CEI) 24, 202, 206, 306, 403, 443, 446
Engineering design (and curriculum for),
- Attitudes of engineers to (UK), 285
- Behavioral approach to teaching of (see Koen)
- Classification of courses, 287
- Concept mapping of 105
- Creativity, 262, 264
- Curriculum integrated, 289
- Diagnostic processes, 309
- In the engineering curriculum, 288 ff
- Freshman approaches to, and programs, 309, 310, 311, 312
- Guided, 248, 249, 250
- Extra-rational behaviour in, 206, 207, 208
- And hard science, 205, 206
- Industrial realism (see also realism), 265, 295, 296, 297
- Influence of engineering disciplines on, 295
- Intellectual development, 155
- Knowledge as design, 298, 299, 300
- As learned behavior 129
- Learning styles 141, 142
- Linear/Non-linear models of, 305, 306, 307, 308
- And mechanical dissection, 98, 223, 302
- And mentors, 299
- Model curriculum, 291, 292
- Objections to teaching of, 284, 285, 286, 287, 300
- And personality, 286
- And philosophy, 53 ff
- And physics, 375
- Project method for, 280, 289, 290, 291, 292, 328
- Reflective practice, 286
- And retention, 312
- Science and design, differences between, 262, 263
- Sequential courses for, 288, 289
- Socially relevant projects 71
- Studio for, 290
- Transition behaviours in, 309
- Teaching of, 297, 303, 304
- And teamwork, 384,
- Way of thinking, 262
Engineers,
- Difference between science and engineering (students), 185, 186, 262, 442
- Supply of (Ch 17), 441
Engineering Perception Test, 406
Engineering designers (UK), 285
Engineering drawing, 129, 285
Engineering education,
- Changes in practice, 461, 462
- Future of, 463, 464
- History of, 284, 285, 304
- Literature of, 459
Engineering graphics 128
Engineering Industries Training Board (EITB), 37, 285
Engineering method (see also heuristics), 243, 250, 251
Engineering design teams, 346
Engineering profession, 463, 464
Engineering Professors Council, 402, 442
Engineering Science (A level) 25, 26, 27, 28, 187, 224, 228, 234, 246, 254, 305, 369, 373, 418, 442
Engineer in Society Examination (UK)
Engineers—functions of (see task analysis) 28 ff
- Competences of 56
- Differences with scientists, 58, 188
- Modes of thinking 25, 55, 58
- Professional responsibility 55, 64
Enhanced engineering courses (UK)
Entering characteristics (see also non-traditional students) 7, 74
Enterprise in Higher Education Initiative 3, 39, 166, 185, 205
Epistemology (see Ch 3) 122
- Knowledge as design, 408 ff
ERM (Education, Research and Methods) Division of ASEE, (See Preface), 433
Essays (learning essays), 162, 429, 431
Ethics and engineering (Ch. 3) 63 ff
- Assessment of 72, 208
- And behaviour 66, 67
- Cheating 66
- Codes of conduct 63, 64, 65, 66
- Definition of 63, 67
- Teaching and morals/moral
- Behaviour 67, 68, 75
- Levels of meaning 69
- And education 64
- Large issues v small issues 69
- Ethical codes, 104,
- Perception of morality (gender) 65
- Purpose of in teaching 63
- Student perceptions of ethics
- Teaching 6
- Teaching of in engineering 65, 66, 68, 69, 72
Ethical dilemmas 72, 208
Ethnography 114, 250
Eureka events, 155
Evaluation (see also assessment), 237, 391 ff
- And curriculum process 11, 12
- In engineering, 397 ff
- Formative, 11, 317, 404, 436
- In higher education, 394
- Illuminative, 335
- Peer, 237
- Qualitative, 395, 396, 400
- Scientific approach to, 395, 396
- Self (see self
assessment/evaluation)
- Summative, 11, 404
- Triangulation, 396
Evaluation (Institutional) (See Ch. 1)
- Audit, 403
- Collaborative, 395
- Program, 393, 394
Evaluator, role of, 393
Examinations (see also assessment, question design, tests) 133, 245, 271, 277, 288
- Anxiety, 438
- Examination passing ability, 279
- Motivation, 169
- Open, 324
- Originality, testing for, 278
- Prior notice, 431
-and temperament 136, 171  
-validity of, 322  
-and visualization 127  
Experiential learning (see cooperative learning, project work etc), 338  
-taxonomy of, 45  
Experimental Investigations, 32, 224, 225  
Expert knowledge (problem solving- see Ch. 4), 203, 251, 254  
Expressive outcomes, 24  
Extraverts/extraversion 136 ff, 298, 330, 331  
EXSEL Coalition, 201, 321  
Eysenck Personality Test 136  
Feedback  
in web based systems, 424  
Feilden Report on Engineering design (UK) 6, 57  
Felder and Silverman’s learning  
Style Theory (Chapter 5)  
applications in engineering 140  
Felder-Solomans Learning Styles Index 134, 140, 335  
Females (see gender, women)  
Finniston Report on Engineering design (UK) 5, 6, 189  
Fischer’s skill theory, 158  
Flanders Interaction Analysis  
Fleming and Bonwell’s learning styles inventory  
“Flow” (concept of), 169, 267  
Focus groups, 191, 322, 409  
Formal curriculum, 178, 179  
Formative assessment (see also diagnosis, self-assessment), 317, 438  
Foundation Coalition, 192, 402, 411  
Foundation curricular (see also bridging courses), 180, 183, 187, 204  
Freshman courses, 182, 183, 185, 192, 449  
Freshman teams, 325  
Frontiers in Education Conference, 459  
Gagné’s taxonomy (theory of learning) 91, 92, 93  
Grading  
-holistic, 431, 435, 436  
Gender (differences) 76 ff, 108, 130, 131  
General (broad – liberal) education 38, 322  
Generic abilities (competences, skills-see personal transferable skills)  
Generic quiz (Felder), 278  
Geometrical and engineering drawing 25  
Goals (see Ch 1, and aims and objectives), 5  
Grading (Ch’s 15 and 16 and assessment, examinations), 344, 345, 433, 445  
-errors in 433  
-global, 423  
-grade inflation, 434  
-holistic, 434  
Graduate profile, 402  
Graduates, skills of (see alumni, employability), 156  
Grinter report on engineering education (US) 5, 284  
Group dynamics, 334, 335  
Group Embedded Figures test (GEFT) 124, 125, 129  
Group learning (see also cooperative learning, syndicates)  
-training for, 338, 339, 345  
Group membership  
-and Afro-Americans, 445  
-and gender, 331  
-heterogeneity in, 327, 329 ff  
-performance and personality, 329 ff  
Guided design, 248, 249, 250  
-generalizability of, 249, 250  
-and personality, 249, 250  
Herzberg, F., 169  
Heuristics, 54, 243, 247, 250, 251  
-in creativity, 262  
-in design, 248, 249, 250, 300, 305, 305  
-Polya’s, 247  
-Saupe’s 247  
Heterophily, 191  
Hidden curriculum 178, 179  
Higher Education Academy, 460  
Higher Education Funding Councils (UK), 447  
Higher education, language of, 26  
Higher Order Thinking Skills (HOTS- see also critical thinking, problem solving) 40, 256, 257  
Higher stages of human development (see intellectual development)  
High School students (see also school technology) 288  
-curriculum for, 206, 207  
-subjects, 207  
Holistic grading, 436  
Home Economics and Physics learning  
Homework, 429  
Homework teams, 339  
Homophily, 191  
Honey and Mumford’s Learning Styles Inventory 134, 135, 333  
Humanities, 35, 70  
-across the curriculum, 206, 207, 208  
-assessment in 72  
-technical content in 73  
hypermedia instruction 142  
Idealism, 54  
Ideas, generation of, 273 ff  
-analogical thinking, 276, 277  
-brainstorming, 273  
-evaluation of, 276  
-lateral thinking, 275  
-morphological analysis, 276  
-analogical thinking, 276, 277  
IEEE Educational Activities Board, 184  
-code of conduct 64  
Illuminative evaluation, 335  
Imagery exercises, 307  
Imrie’s Recap Taxonomy (Ch 2)  
Incorporated programs, 200  
Independent learning/study, 187, 189  
Individualised Learning see Ch 14 and also, Keller plan, mastery learning, PSI, 359 ff  
-computer based, 359, 362  
-design of 386  
-feedback in, 366  
-grading of, 364  
-levels of learning skill in, 366  
-off campus, 367  
-procrastination in, 361  
-proctors, 359, 366, 367  
-semi-paced teaching, 365, 366  
-special centers for, 362  
-role of teachers in, 368  
Inductive reasoning, 252, 254  
Industrial design, 284  
Industrialists-perceptions of quality 39  
Industry,  
-skill training for, 296, 297  
-and engineering education 38, 184, 185, 186  
-and higher Education 38  
-value of teamwork, 339  
Informal curriculum, 178
Inquiry based learning
(discovery), 373, 374, 375, 376, 384
-and Kolb learning cycle, 374, 375
-process of, 373
-syllabus coverage, 374
Insight, 155
Institute of Learning and Teaching in Higher Education, 420
Institution of Chemical Engineers, 222
Institution of Civil Engineers, 403
Institution of Mechanical Engineers 56, 64, 75, 285
Institution of Production Engineers 56
Instructor accessibility,, 407
Instructional climate, 450, 451, 452
Integrated programmes, 201ff
-close/distant subjects 200, 206
-and cooperative learning, 204, 205
-core programs, 188, 189
-definition of, 200, 201, 202
-evaluation of, 217
-engineering with social science, 210
-freshman, 416
-in laboratories, 376, 377
-problem based learning, 200
-and women 204
-writing with engineering, 199, 200, 205, 206
Integration, 190, 199ff
-by project work, 200, 204, 210, 212, 223, 288, 389
-of industrial training with academic work ,264
-need for theories of, 217
-of multi-media, 201, 217
-within subjects, 181
-student commitment to, 207, 208
-and student learning, 202
-and student numbers, 217
-student perception of, 290
Intellectual development (see Ch 6 )
-change/development, 157
-Crux model (curriculum, teaching) 161, 162
-curriculum and curriculum planning, 154, 155, 156, 159, 160
-and experience of college, 160
-Fischer’s theory, 158
-and graduate skills, 156
-and instruction, 153, 157
-levels of, 156,
-marker events, 154, 155
-and modular courses, 162, 405
-reflective judgement model (RJM), 154, 158, 159, 160
-RJM compared with Perry, 158, 159
-Perry model, 153 ff
-Intelligence, 158,161, 162
-emotional (also social), 165, 166, 167
-practical, 165
Interdisciplinary institutions, 199
Interdisciplinary programmes, 199 ff
-humane across, 206
-and retention, 199
-transfer of learning in, 233
-writing, 205, 206
Interdisciplinarity, 199 ff
International Baccalaureate, 447
International Technology Association, 442
Interpersonal process recall, 408
-and women and minorities, 204
Interpersonal skills (see also personal transferable skills), 41, 42, 43, 45
Introvert/Introversion, 136, 330, 331
Institution of Chemical Engineers examination, 222
Instructors (see teachers)
Instruction (see teaching), 322
-adaptation of students to new methods, 318
-comparison of methods, 318
-matched to objectives
-objectives 22
Student Centered, 319, 371, 372
-variety of method, 411
Integration
-theory with practice, 376
Integration
-theory with practice, 376
Job analysis and the curriculum 30 ff
-and attitudes to job 30, 34
-criticisms of some approaches 28
-techniques of interviewing, 30
Joint Matriculation Board (JMB) 25, 28, 442
Journals (Journaling, and diaries, log books) 72, 202, 237,417, 418, 419
Jung, C. G.(Ch 5), 330, 331, 332
Just in time curricula, 200, 202
Judgments, making of, 159, 230, 431
Keller plan (see individualised learning), 359
Key concepts (Ch 4. See also concept learning) 100, 101, 102
-and design of the curriculum, 11, 100, 109, 110, 184
-in learning 100
Kiersey and Bates modification of the MBTI
Knowledge (see and prior knowledge), 188
-common sense, 189
-conceptual 91
-content 105, 106
-declarative 103
-as design, 300 ff
-as information, 300
-procedural 103
-relativity of, 154
-strategic, 9
-tacit, 167
Kohberg’s theory of moral development (Chapter 3, 6)
Kolb’s theory of learning styles and associated inventory 98, 130, 131
-adaptations of 130, 132,
-applications 131, 132, 134, 335
-Cowan’s modification of 133
- 4 MAT Learning Style approach 119, 130
, 144, 145
-what it measures, 133
Kolbe Corporation Index, 331
Koort-Reilly Cognitive/emotional model, 168, 169
Laboratory Practicals (aims and assessment), 199, 204, 368 ff
-attitudes to 37
-classification of, 368
-cognitive apprenticeship, 384
-in distance education, 369, 371, 379, 380
-hands on experimentation, 379
-integrating theory and practice, 376
-Laboratory Aims Questionnaire, 369
-Student centered, 371, 372
-Lab versus simulation, 368, 376
-Labour arenas
-Landis Skills Inventory 121
-Lateral thinking, 275, 276, 328
-Laplace transforms, 21
Leadership (see curriculum leadership- preface and Ch 1), 396, 461
Leadership, training for, 340, 341, 342
Learners (analytic, global, serialist, synthetic)
Learning (Ch’s 4, 5, 6)
- active, 229
- adjustment to new types of, 133
- and ambiguity, 286
- cognitive emotional state, 168, 169
- contract, 229
- creativity, 269, 270, 271, 271, 272, 273
- critical incidents in, 156
- communities, 452
- cultural bias, 322
- deep (see deep learning) 105, 119, 120, 121, 143, 322, 425
- difficulties, 407
- dissonance (see cognitive dissonance), 154, 155
- experience, effect of on, 273
- goal setting 92
- inquiry based (discovery), 373, 374, 375
- in integrated courses, 202
- and media, 163
- on one’s own, 294
- platforms for, 209
- readiness, 163, 164
- rote 103
- Saupé’s principles of, 245, 247, 325
- self, 187
- strategies for, 322
- surface, 119, 120, 121
- and technology, 380, 381, 382ff
- theories of (see ch ) 36
- in 3D, 129
- transfer of, 92, 122
Learning communities, 450, 451, 452
- student apathy to, 453
- and web based learning, 453
- and women and minorities, 451
Learning Environment Preference Schedule
Learning how to learn, 269, 449
Learning journals, 416
Learning outcomes in engineering, 40, 41
Learning strategies 119, 120, 121, 122
Learning styles (Ch 5. See also cognitive style, and Kolb’s learning Style, Felder, Honey and Mumford), 122ff
- and ability/ achievement 125, 132
- and age
- and assessment
- and behaviour 135, 136, 138
- an coaching/ counselling 121, 140
- and cognitive style 119, 143
- cognitive style analysis, 143
- and conceptions of learning 122
Convergent/divergent, 123, 126, 128, 130
- cultural effects on 130
- and engineering drawing
- and engineering students 130, 131, 134, 138, 139
- and gender 130 131
- holist/serial 122
- and industrial need 135, 136, 138
- convergent-divergent 123, 126, 130
- Felder and Silverman/Soloman, 140ff
- field dependent-field, 95
- independent 124, 125
- Honey and Mumford
- Instrument, 134, 135
- humanities 123, 124
- Individualized environments, 144
- naturalistic approaches to
- and problem solving 132
- and reflective practice 132
- and teaching 119, 122, 123, 131, 132, 133, 135, 140, 141, 145
- and teamwork 141, 142
- and temperament 136 ff
- and textbook design 145, 146
- Lecture method, 317, 318, 319
- “voting” lecture, 318
- Lesson planning (ch 1, ch 2) 134, 143
- Liberal arts students in engineering courses, 213
- Liberal education and engineering, 54, 56, 71
- Liberal education/learning 15, 184, 187, 206, 208, 210, 256, 262
- Liberal Learning, White paper (see Ch 3) 200, 205
- Lifelong learning, 164, 185, 186
- and allocation of resources, 163
- Log books (see journals)
- McMaster problem solving course, 254, 255, 256
- Macroschema (see schema)
- Management (skill of) 31, 167
Management Charter Initiative, 166
Marker events, 154, 155
Marking (see also grading)
- Cross checking, 428
- holistic, 433
Maslow’s hierarchy of needs, 169
Massachusetts Institute of Technology (MIT)
Mastery learning (see also individualised instruction), 360
- compared with PSI, 360, 364
Mathematics, 37, 54, 181, 182
- of new entrants, 446
- and decision to enrol, 453
MBTI, 122, 123, 137, 138, 139, 140, 287, 298
Mechanics (see Ch 4) and 181
Mechanical dissection (see engineering design)
Memory 121
Mental models, 104, 203
Mental rotation Test 127
Mentors (mentoring), 289
- role of
- and teaching assistants
Meta-cognition, 245, 253
Metacognitive skills inventory, 95
Minority Students, 76, 188, 204
- interventions with, 445
- and learning communities, 451
- preparation for higher education, 445
Minute paper, 344
Mission statements, 4, 5, 6
Mock trials, 359
Modularised courses 37
Moral development (see Kohlberg) 64 ff
- and gender 65
Moral purpose (in engineering), 67
Morphological analysis, 276
Motivation (confidence of students) 106, 107, 164, 168, 169, 170, 171, 185, 189, 212, 223, 224, 225, 233
- and creativity, 169, 265, 267
- in confidence log, 293
- and flow, 169
- in cooperative learning, 325, 326
- in engineering design, 286, 288, 291, 292, 293
- extrinsic 120
Motivated Strategies for learning Questionnaire, 274
One minute paper (see minute papers)
Operational (working)
philosophy 55, 56, 57
Oral examinations, 432, 434
Organizational structure 4, 16, 30, 81
-and curriculum 4, 16
Originality 26
Outcomes
-ABET EC 2000 23
-engineering, 45
-expressive 24
-intended 24
-political issues 15
-programme 22
-unintended 24
-terminology 21, 24
Outcomes (based) assessment
-and Engineering Council
(UK) 22ff
-organizational structure 4, 16
-overload 6, 60
-transfer value of 15

Paedia Proposal, 248
Page report (Institution of Mechanical Engineers), 446
Paper Folding Test 127
Participation (see retention), 453, 454
Peer assessment, by students (evaluation, review), 423ff
-in case studies
-performance index, 237
-reliability of, 342, 422
-student design of, 342
-and teacher overload, 421
-in teamwork, 342, 342, 345, 423
-training for, 427
Peer tutoring (see mentors, proctors), 318, 366, 367, 451
Perception (see concept learning)
Performance based assessment
(see also outcomes based assessment)
Perkins theory of knowledge as design, 285, 295, 299 ff
Perry’s theory of intellectual development (see intellectual development), 153 ff
Personality 136 ff
-effect in groups, 298, 299
Planning (skill in)
Personal skills project, 38, 166, 167
Personal transferable skills (see also transferable skills) 38, 166, 167 205,
-and course design, 38, 167
Personalised Instruction (PSI)
(see CH 14, and individualised instruction, Keller Plan)
Philosophy (and engineering education) 53 ff
-application to curriculum design
54, 182
-operational philosophy, 55, 56, 57
-Screening 12, 15, 16
Pittsburgh Writing Scheme, 420
Polya’s heuristic (see heuristics), 247, 261
-modified, 247, 254
Polytechnics, 399
Portfolio’s, 23, 420ff
-assessment of, 344, 418
-development or growth type, 421
-electronic, 401, 421
-and project reports, 420
-and records of achievement, 420
-reliability of, 422
-show case type, 420
Post formal reasoning (see intellectual development), 153ff
Power test, 431
Prior achievement, 448
Prior knowledge (and knowledge acquisition) 75, 106, 230, 254, 322, 344, 373
-assessment of, 94, 105, 120, 121, 142
-experience, 232, 234
-skills for teamwork, 339
-tests for 96
Prior notice examination, 431
Problem based learning (Ch 9-see also project based learning and projects) 229 ff
-assessment in, 230, 234ff
-and cases, 230
-described, 229
-diary, 422
-preparation for 233
-role of faculty in, 237, 238
-role of student in, 238
-student attitudes to, 232, 233, 234
-and syllabus coverage, 234, 235
-and teamwork, 232, 233
-and workload, 232
Problem formulation, 251
Problems, design of...
-closed, 244
-ill structured (wicked), 244
Problem solving (see Ch 10) 40
75, 155, 156, 164, 190, 228, 229, 243, 324, 399, 400
-approaches to, 243, 331
-assessment of, 245, 246
-childrens approaches to, 301
-and creativity, 261
-defining, 310, 311
-and design, 305, 306
-domains of, 22, 32
-and graphics 22
-Guilford’s creative problem solving model
-and heuristics, 128, 243, 247
-identification of problems, 228
-information processing, 255
-and learning styles 132
-levels of difficulty in, 244
-ended (ill structured), 286, 333
-and spatial ability 127
-qualitative approaches to 251, 252
-representational transformations, 252
-and set mechanisation, 132, 250, 251, 252
-as a specific discipline, 253, 254
-teaching for, 246
-technology as, 443
-types of problem solver, 331
Problem solvers, characteristics of, 255
Product champion, 193, 194
Product design, 284
Professional competence, 157
Profiles, 437
Program assessment (Ch 15), 23, 24, 392, 402ff
Program objectives 45
Projects (Ch. 9, and Ch 12, see also problem based learning), 221ff
-aims of, 32, 222
-assessment of, 222, 234 ff
-and course loading, 235
-childrens activities in, 293
-choice of by students, 189, 225, 339
-choosing alternatives (skill in), 298
-complexity of learning in
-definition of (Ch 9 and PBL)
-design and make, 414
-and engineering design (see Ch 12)
-evaluation of, 228
-and examinations, 235
-externally sponsored, 326
-final year, 222, 337
-and integration, 223
-and integrated programs, 200
-intergroup, 336, 337
-and lifelong learning, 164
-motivation, 212, 221 ff
-and negotiated curriculum, 60, 189
-portfolios, 237, 401
-planning, 328
-product and manufacturing
-real world(realistic), 169, 221, 227
-and reflective practice, 228
-role of faculty, 224, 237, 238
-rubrics for, 234, 235
-self-confidence, 232, 233
-skills for planning, specifying and evaluation, 228, 232
-in software engineering
-stakeholders
-student adaptation to PBL, 232
-student learning, 233, 234
-and teamwork, 222
-types of, 222
-system design project, 289
Project Outlines, 228
Project Technology (UK), 27, 223, 224, 442
Protocols (think aloud techniques) 1-2, 114, 123, 309, 335, 400, 401, 407
Pseudo learning groups
Psychometric profile testing 175
Psychomotor domain, taxonomy of, 43
Pupils Attitude to Technology Foundation (PATT) 75
Purdue Spatial Visualization Test 127
Quality Assurance Agency (QAA), 392
Quality circles (TQM), 324
Qualitative thinking, 94, 108, 113, 245, 251, 252, 398, 399, 400
Quebec Ministry of Higher Education
Questions (items) (see also problem solving)
-design of, 120, 123, 244, 245, 256, 277, 271, 432, 433
-in group work, 345
-prior notice, 431
-short answer, 431
-skill in questioning, 277
Questionnaires, validity of, 398
Readiness, 163, 164, 192
“real” engineering in courses
(perceptions of reality) 98 108, 114, 158, 244
-real versus simulation, 128, 132
-realism, 337
-reality 209, 229, 295, 296, 328
-relevance, 169, 190, 203
-relevance, 190, 203
Realism (Philosophical), 57
Reasoning, 256, 257, 258
RECAP taxonomy
Received curriculum
-and control of knowledge and national culture
-as a spiral
Records of achievement
Recording Enterprise Assessment of Learning group (REAL), 30
Reflective judgement (model of), 158, 159, 160, 256, 257
Reflective Judgment Interview (RJI), 159, 160
Reflective practice, 157ff, 417, 418, 419
-in design, 286, 308, 309
-and evaluation, 160
-in liberal education, 73
-and portfolios, 428, 419
-Schön model of, 160
-in teamwork, 328
-training for, 417
Repertory Grid technique, 408
Retention (see attrition, non-completion, participation persistence), 291, 292, 441 ff
-first year (freshman) 449
-on PSI courses, 361
Research assessment exercise (UK)
Research (see educational research)
Riding’s cognitive style analysis
Role playing, 68, 249, 295, 296
Rubrics, examples of, 32, 33
Sandwich (cooperative) courses, 3, 178
SARTOR, 3, 177, 180, 183
Saufe (model of learning), 247, 325
SCANS report (U.S), 40, 164, 199, 212 ff
Scholastic Aptitude Test (SAT)
Schools and careers (Chp 17), 183
Schools Council, 293
School Technology, 441, 442, 443
Science versus engineering, 58
Screening (aims and objectives), 12, 15, 16, 74, 89
Selection
Self actualization, 330
Self-assessment (also self evaluation), 204, 206, 230, 249, 343, 401, 417, 427ff
-reflective practice, 427
-setting own goals, 430
-training for, 428
-versus self evaluation, 427
Self-directed learning, 164
-Grows model of, 164
-flow, 174
Self-esteem
Self-evaluation/self report (see self assessment)
-criticisms of in research, 321, 322
Self-knowledge (reflection), 427
Self Paced instruction (see individualized instruction)
Self Report Inventory, 35, 337, 406
Semi-paced learning
-motivation, 169
Set mechanization 132, 250, 251
Simulation (see also, case studies, debates, laboratory work, projects, and “real”), 295, 296, 327, 328
-hands on, 377, 378, 379
-industries need, 377
Single room class, 452
Sketching 129
Small group-work (see cooperative learning, groupwork, syndicates)
Small Group Environmental Rating Form, 337
Social competence
-test of, 167
Social (emotional) intelligence (Ch 6), 200
Society of German Engineers, 178
Society for Manufacturing Engineers, 185
SOLO Taxonomy, 41, 270, 271, 433
Solomans learning style
Inventory 139
Something about Myself Inventory (SAM), 272
Spatial ability (reasoning- see also visualization), 125ff
-computer assisted training for 125, 127, 128
-and gender, 127, 128
-and mathematics 125, 127
-three dimensional learning 125
-training for within engineering graphics 127
Specialist versus generalist curriculum, 187
Spiral curriculum, 164, 186, 187
Staff Development Association, 420
Standards, 22, 24
-for technological literacy, 180
Strong Vocational Interest Blank 125
Students
-and course loading, 448
-and design of grading, 346
-as instructional designers, 302
340, 375
-perception of courses, 445
-perceptions of self, 372
-perceptions of teachers, 157
-opinion polls
-and reading, 323
-resistance to change, 318
-setting goals, 168
-supply and demand for
Student motivation (see motivation)
Student ratings, 405, 406, 407
Study/habits skill, 121, 200
Subject disciplines, 180
Subject review, 394
SUCCEED Coalition, 192, 204
Supply and demand of students, 74, 183, 184, 443ff
-Transition from school to college, 450
-value of interventions in schools, 445
-entry standards, 446
-interventions by universities in schools, 444, 445
-and school education 441, 442, 403
Surface learning (see learning), 234
Survey research, 406
-longitudinal, 410
Syllabus (content) 16, 431
-in Problem based learning
Syndicates, 323
Synectics, 275
Synthesis (skill of), 26, 27, 40, 155, 164, 222, 224, 229, 248, 261, 262, 265, 429
Systems studies (of engineering education), 35
Task analysis (of engineers), 28 ff
Taxonomy of Educational Objectives (Affective domain), 41, 42
Taxonomy of Educational Objectives (Bloom Taxonomy-cognitive domain) 20ff, 244, 246
-and ABET 25
-action descriptors 25, 29
-the analysis of jobs, 36
-applied to industrial occupations, 47, 48
-categories of, 23, 26
-creativity of, 21, 22, 25
-classes (categories) of 23, 26
-cognitive domain, 23
-comprehension, category of
-criticisms of, 21 ff, 26
-evaluation, category of, 425
-hierarchical nature of (levels of knowledge), 20 23
-impact of, 25 ff
-influence on engineering education, 25ff
-instruction, 22, 23, 25, 49
-problem solving, 21, 22
-psycomotor domain, 43
The Taxonomy applied to teaching, 22, 23, 24, 28
-geometrical and engineering drawing, 30
-industrial engineering, 27, 28, 33
Taxonomy of Engineering education (Carter), 27, 43, 48
Taxonomy of experiential learning, 41
Taxonomy of Higher Education Objectives, 394
Taxonomies of industrial engineering, 47, 48
Taxonomy of problem solving, 244, 245
Teachers (Instructors, tutors),
-expectations of students, 169
-interaction with students, 449
-involvement with schools, 446
-perceptions of learning, 171
-perceptions of quality 39
-relations with students, 157
-role of, 297, 298, 317, 319, 368, 386, 454, 461
-training for, 223, 238, 338, 419, 459
-well being of.
-workload of, 271, 271, 385
Teacher as researcher (reflective practice-see Preface), 252
Teaching (instruction)
-effective, 454
-groups and teams, 343, 344 -
and intellectual development, 157, 159, 161
-objections to teaching design
-and philosophy 58
-and risk taking, 319
-student centred, 319
-style, (Ch 5) 133 ff
-and theories of learning 54
-training for, 459
-variety in 146
Teaching strategies (see instruction)
Team developer Computer Based
Peer Rating Survey, 342
Team Environment Survey, 337
Teamwork (Ch 13- see also cooperative learning)
-assessment of, 326
-Belbin team roles
questionnaire, 329
-in capstone design project
-in engineering design, 296, 328
-evaluation of, 343, 344
-in integrated programs, 205
-interdisciplinary, 328
-negative team behaviours, 330
-peer assessment of
-peer groups, 326
-personality, 329, 330 ff
-preparation for, 335, 336, 338, 339, 343
-science of engineering teams, 346
-selection of, 324 ff
-size of, 333
-team building, 297, 343
-team management skills, 161
-training for teamwork, 165
-value of in industry, 339
-and women, 331
-and workload, 343
Technical Foundation of
America, 442
Technical writing, 424
Technicians, attitudes of 30
Technological literacy
Technologie (French schools), 442
Technology and schooling 75, 76, 441, 442, 443
Technology and instruction 141, 142, 143, 380, 381, 382ff
-comparison with conventional instruction, 382, 383, 384, 385
-and principles of learning, 386
Temperament and performance
Technique versus rigor, 182
Technologist (definition of,) 188
Terminology, problems with, 10, 21, 229
Test design 133
Textbooks and learning, 229, 323
Thermatic integration, 209
Thematic Aperception Test, 39
Tipperary Leader Group, 165
Total Quality Management
(TQM), 194, 291, 292, 324, 461
Transdisciplinarity, 199, 200, 209, 210
Transfer of learning, 39, 182, 183, 201
-analogical
Transferable skills (see personal transferable skills), 39, 41, 42, 43, 44, 48
Transition behaviours, 309
Transition, School to University, 450
-college to workplace, 40
T Groups, 410
Tutors (see instructors, teachers)
UCAS, 74
Universities intergroup work, 336, 337
Validation, 392
Validity, 244, 246
Values, teaching of (see moral judgment)
Visual communication 141, 142
Visualization (compared with spatial ability), 125ff
Vocational Preference Inventory
(Holland) 133
Wallas, model of creative thinking, 266, 307, 308
Wave Concept Inventory, 20
Whistleblowing 64, 66
Whitehead’s theory of rhythm in education, 164, 186, 212, 446
Wilde’s theory of engineering teams, 330 ff
Women 76, 77ff
-attitudes of male teachers to, 452
-biomedical engineering, 444
-design competitions 79
-difficulties in engineering 76 ff
-and grades, 448
-and interdisciplinarity, 204
-and learning communities, 451
-and role models, 78, 80
-and self-confidence, 294, 295
-summer camps for, 444
-and teaching methods, 77, 78
-in teams, 331, 336
-and testing, 77
-ways of knowing, 79, 80, 132
Women in Science and Engineering Campaigns (WISE)
444, 445
Work keys assessment tests, 211, 212
Writing,
-across the curriculum, 199 ff
-to learn, 199 ff