# Contents

Preface, xiii  
Acknowledgments, xv  

## 1 Prologue

1.1 General Introduction: The Functions of Assessment, 1  
1.2 Health Warning: Ambiguities in the Use of the Term “Assessment”, 6  
1.3 The Assessment of Persons for the Professions, 8  
1.4 The Engineering Profession, 10  
1.5 The Development of Higher and Engineering Education as Areas of Academic Study in the 1960s, 12  
1.6 Assumptions About Examinations: Reliability, 12  
1.7 Myths Surrounding Examinations, 14  
1.8 The Introduction of Coursework Assessment, 17  
1.9 Rethinking Validity, 19  
1.10 Wastage (Dropout): The Predictive Value of School Examinations for Satisfactory Performance in Higher Education, 20  
1.11 Factors Influencing Performance in College Courses, 22  
1.12 Assessment: Results and Accountability, 25  
1.13 Assessing the Learner, 26  
Notes, 27  
References, 27

## 2 Assessment and the Preparation of Engineers for Work  

2.1 Engineers at Work, 36  
2.2 An Alternative Approach to the Education and Training of Engineers for Industry, 37  
2.3 Toward an Alternative Curriculum for Engineering, 42  
2.4 Creativity in Engineering and Design, 43  
2.5 Furneaux's Study of a University's Examinations in First-Year Mechanical Engineering: The Argument for “Objectives”, 48  
2.6 Discussion, 51
CONTENTS

Notes, 53
References, 54

3 The Development of a Multiple-Objective (Strategy) Examination and Multidimensional Assessment and Evaluation 61

3.1 The Development of an Advanced Level Examination in Engineering Science (For 17/18-Year-Old High School Students): The Assessment of Achievement and Competency, 62
3.2 Skills Involved in Writing Design Proposals and Practical Laboratory Work, 72
3.3 A Balanced System of Assessment, 74
3.4 Pictures of the Curriculum Process, 75
3.5 Multidimensional Assessment and Evaluation: A Case Study, 79
3.6 Discussion, 83
Notes, 84
References, 85

4 Categorizing the Work Done by Engineers: Implications for Assessment and Training 89

4.1 Introduction, 90
4.2 A Study of Engineers at Work in a Firm in the Aircraft Industry, 91
4.3 The Application of The Taxonomy of Educational Objectives to the Task Analysis of Managers in a Steel Plant, 96
4.4 The Significance of Interpersonal Competence, 96
4.5 A Comparative Study of British and German Production Engineers (Managers), 101
4.6 Engineering Knowledge, 103
4.7 Discussion, 105
Notes, 105
References, 107

5 Competency-Based Qualifications in the United Kingdom and United States and Other Developments 111

5.1 The Development of Competency-Based Vocational Qualifications in the United Kingdom, 112
5.2 Outcomes Approaches in High Schools in the United Kingdom, 115
5.3 Standards in Schools in the United States, 116
5.4 Education for Capability: Capability vs. Competence, 117
5.5 Ability (Assessment)-Led Curricula: The Alverno College Model, 119
5.6 The Enterprise in Higher Education Initiative in the United Kingdom and the SCANS Report in the United States, 122
CONTENTS

5.7 The College Outcome Measures Program, 125
5.8 Discussion, 127
Notes, 130
References, 130

6 The Impact of Accreditation 133
6.1 ABET, European Higher Education Area (Bologna Process), and the Regulation of the Curriculum, 134
6.2 Taxonomies, 135
6.3 Outcomes-Based Engineering Education, 142
6.4 Mastery Learning and Personalized Systems of Instruction, 147
6.5 Discussion, 152
References, 152

7 Student Variability: The Individual, the Organization, and Evaluation 157
7.1 Introduction, 158
7.2 Learning and Teaching Styles, 161
7.3 Study Habits/Strategies, 163
7.4 Intellectual Development, 165
7.5 Critical Thinking, 168
7.6 The Assessment of Development, 172
7.7 The Reflective Practitioner, 174
7.8 Adaptive Expertise, 180
7.9 Discussion, 181
Notes, 182
References, 183

8 Emotional Intelligence, Peer and Self-Assessment, Journals and Portfolios, and Learning-How-to-Learn 189
8.1 Introduction, 190
8.2 Emotional Intelligence, 191
8.3 Self- and Peer Assessment, 193
8.4 Learning Journals and Portfolios, 206
8.5 Learning-How-to-Learn, 209
8.6 Discussion, 210
Note, 211
References, 211

9 Experiential Learning, Interdisciplinarity, Projects, and Teamwork 217
9.1 Introduction, 218
9.2 Project Work as a Vehicle for Integrated Learning and Interdisciplinarity, 219
## CONTENTS

9.3 Learning to Collaborate, 220
9.4 Constructive Controversy, 224
9.5 Communication, Teamwork, and Collegial Impediments to the Development of Good Engineering Practice, 225
9.6 The Demand for Skill in Innovation: Can It Be Taught?, 227
9.7 Creativity, Teamwork, and Reflective Practice (See Also Section 2.4), 228
9.8 Can Teamwork Be Taught?, 229
9.9 Discussion, 235
References, 236

10 Competencies 241
10.1 Introduction, 242
10.2 The Iowa Studies (ISU), 244
10.3 The Outcomes Approach in Australia, Europe, and Elsewhere, 246
10.4 The CDIO Initiative, 247
10.5 A Standards-Based Approach to the Curriculum, 248
10.6 Recent European Studies, 252
10.7 Impact of Subjects (Courses) on Person-Centered Interventions, 255
10.8 The Potential for Comparative Studies: Choosing Competencies, 256
10.9 Expressive Outcomes, 258
10.10 Discussion, 259
References, 260

11 “Outside” Competency 265
11.1 Introduction, 266
11.2 Accidental Competencies, 267
11.3 Understanding Competence at Work, 269
11.4 Contextual Competence, 270
11.5 A Post-Technician Cooperative Apprenticeship, 272
11.6 Theories of Competence Development in Adult Life, 275
11.7 Discussion, 278
Notes, 279
References, 280

12 Assessment, Moral Purpose, and Social Responsibility 283
12.1 Introduction, 283
12.2 Moral Purpose and the Power of Grading, 284
12.3 From Reliability to Validity: Toward a Philosophy of Engineering Education, 284
12.4 Screening the Aims of Engineering Education, 285
CONTENTS

12.5 The Role of Educational Institutions in the Preparation for Industry (the Development of Professional Skills), 287
12.6 The Role of Industry in Professional Development, 289
12.7 Assessment and the Curriculum, 290
12.8 Changing Patterns in the Workforce, the Structure of Higher Education, 291
12.9 Lifelong Education and Credentialing, 293
12.10 Conclusion, 295
Notes, 297
References, 298

A A Quick Guide to the Changing Terminology in the Area of “Assessment” 301
A.1 Objectives and Outcomes, 301
A.2 Assessment and Evaluation, 307
References, 308

B Extracts from the Syllabus and Notes for the Guidance of Schools for GCE Engineering Science (Advanced) 1972 Joint Matriculation Board, Manchester 311
B.1 Extract 1 (pp. 2–6), 311
B.2 Extract 2 (p. 9), 317
B.3 Extract 3 (pp. 13–16), 318

Author Index, 325
Subject Index, 339