

Acknowledgments .....	5
Index .....	6
Resum .....	9
Summary .....	11
Resumen .....	13
1 Introduction .....	15
1.1 Motivation.....	15
1.2 Objectives and methodology.....	18
1.3 Contents.....	21
1.4 Background .....	22
2 The assessment process .....	24
2.1 Introduction .....	24
2.2 Evaluation according to its function .....	26
2.2.1 Diagnostic Assessment .....	26
2.2.2 Formative assessment.....	27
2.2.3 Summative assessment .....	28
2.3 Evaluation according to its timing .....	29
2.3.1 Initial assessment .....	29
2.3.2 Partial assessment.....	30
2.3.3 Final assessment.....	30
2.4 Evaluation according to its performer .....	30
2.4.1 Self-assessment.....	30
2.4.2 Peer-assessment .....	31
2.4.3 External evaluation.....	31
2.5 Curricular assessment .....	32
2.6 Evaluation according to its nature .....	33
2.6.1 Criteria and normative assessment .....	33
2.6.2 Qualitative and quantitative assessment.....	33

2.6.3 Continuous assessment.....	34
2.7 The evaluation in a historical perspective.....	34
3 Activities and competencies .....	37
3.1 Introduction .....	37
3.2 The concept of competence.....	38
3.3 The competence-based assessment.....	41
3.4 Mathematical competences .....	45
3.4.1 Niss' eight competences.....	45
3.4.2 Competences dimensions .....	49
3.4.3 Mathematical competences in OECD PISA .....	50
3.4.4 An example.....	53
3.5 Activities.....	56
3.5.1 Characterization and their impact on competences.....	56
3.5.2 Lectures.....	57
3.5.3 Assignments .....	61
3.5.4 An assignment example.....	65
3.5.5 Mathematics laboratories .....	67
3.5.6 Flipped learning at Math Labs .....	69
3.5.7 Written exams.....	71
3.5.8 eLearning activities.....	72
3.5.9 Other activities .....	74
4 A procedure to compute continuous assessment .....	77
4.1 Introduction .....	77
4.2 The continuous assessment process .....	79
4.2.1 Background .....	79
4.2.2 Features from the KOM project.....	86
4.3 Active/retroactive continuous assessment process.....	88
4.4 A case: continuous assessment of Mathematics I at ETSID.....	96

5 The ATC cuboids in assessment of mathematical activities .....	105
5.1 Introduction .....	105
5.2 Assessment by rubrics .....	106
5.3 Binary assessment of activities based on competences .....	109
5.4 ATC components .....	113
5.5 Personal ATC cuboids .....	115
5.6 Grading and targeting with ATC cuboids .....	117
6 A comparison between ATC methodology and traditional evaluations ...	119
6.1 Introduction .....	119
6.2 Competences .....	120
6.3 Sample and elements to assess. Master ATC.....	121
6.4 Retroactivity .....	122
6.5 An implementation of the ATC evaluation.....	125
6.5.1 Activity backlog.....	126
6.5.2 Retroactivity .....	130
6.5.3 Personal ATC cuboid.....	130
6.5.4 Evolution graphics .....	135
6.5.5 Results on total sample .....	139
6.6 Comparative results .....	142
7 Dynamic assignments .....	145
7.1 Introduction .....	145
7.2 Objective ATC .....	145
7.3 Master ATC.....	146
7.4 The activity bank .....	148
7.5 The activity backlog .....	153
7.6 ATC data structures .....	156
7.7 Retroactivity .....	158
7.8 Activities assignment.....	159

8 Conclusions and future work.....	164
8.1 Conclusions .....	164
8.1.1 Introduction .....	164
8.1.2 The method in key concepts.....	165
8.1.3 Questions review.....	167
8.2 Future work.....	172
References .....	175
Annex I: ATC data from a sample of students.....	197
I.1 Student A1.....	197
I.2 Student A2.....	200
I.3 Student C1.....	203
I.4 Student C2.....	203
I.5 Student D1 .....	206
I.6 Student D2 .....	209
I.7 Student F .....	212