Using Gamification to Improve Participation in Social Learning Environments

Author: Jorge Manuel de Azevedo Pereira Simões
Supervisors: Dra. Rebeca Díaz Redondo
Dra. Ana Fernández Vilas

2015
Acknowledgements

Without the collaboration, support, advice and insights from several people, this work would not have been possible.

First, I have to thank the encouragement and patience of my closest family, my wife, my daughter and my son. Along the years that this research took, I could not be present in their lives as much as I wish.

I would like to express all my recognition to my supervisors, Professoras Rebeca Díaz Redondo and Ana Fernández Vilas for their support, suggestions and feedback.

I am due a special and important recognition to Ademar Aguiar for all of his ideas and advice that were so helpful for the research and to have found the time to give his continued support. Also to the development team from Schoooools to have received me as one of them for the time I spent in the project.

I am highly grateful to Professor Sérgio Mateus and his 3rd-grade class at Escola Fernando Pinto de Almeida. Without them, the research’s experiment would not have been possible. I have to particularly thank Sérgio, who helped me to conduct and collect the data for this research and also gave important contributions in the experiment’s settings.

A special gratitude to Escola Profissional de Esposende and to my students there that allowed me to conduct a pilot test prior to the experiment. The same gratitude goes to the trainees from TecMinho gamification course that used and tested an instrument that is part of this thesis contributions. Also a special note to Professora Carla Morais from University of Porto for her advice on how to set up the experiment and what empirical methods should I consider.

I am very recognized to Instituto Superior Politécnico Gaya and all the faculty members, for allowing me to take the time I needed to take and conclude this research.

During the research, I have received important help from several other people that are impossible to name individually: all the gamification experts that I followed on Twitter and other social networks over the past few years. Many of them gave important hints and shared important contents that I used in the research. And with all of them I was able to be up to date with everything that was happening around gamification.

Finally, I would also like to leave a note of gratefulness to my sister Manuela, for her comments and suggestions in revising my English.

Abstract

This thesis addresses the problem of students’ disengagement by investigating if gamification can make a contribution to solve the problem and how. Gamification is a new trend that aims to improve people’s engagement, motivation, loyalty or participation. It started as a marketing tool but widespread to several different areas where peoples’ involvement is a key issue. Gamification is inspired by the success and popularity of video games and looks for ways to use game’s features in non-game contexts, as a way to drive game-like engagement.

While schools are struggling with the lack of motivation and engagement of many of their students, technology is part of most children and teenagers lives in today’s societies. They are heavy users of several media that, through mobile and wireless technologies, are almost permanently present and available everywhere. Schools have to compete for students’ attention and time and find the ways to use technology in their favour and fill the gap between school and the outside technological world. Also, most of today’s students are video game’s consumers. Games have been used in educational and training scenarios for a long time. But building full-fledged games with learning purposes has high implementations costs.

Gamification is a way to take advantage of the games’ power with lesser costs and effort. An initial research on gamification revealed that education was precisely one of the main fields that could benefit from this new trend. As a main goal, the thesis proposes a framework to help teachers using technology-enhanced learning environments powered with gamification. It is expected that these environments can improve students’ behaviors towards school and learning. The framework also defines what should be the high level architecture of gamified digital systems. This architecture is platform independent and is proposed as a way to help developers in the implementation of gamified systems, by highlighting what their main building blocks should be. Based on a broad literature review, this thesis presents the most used game elements and game techniques found in already existing gamified applications. A set of those elements and techniques were included in the proposed framework.

Further research was needed to investigate the impact of gamification and how to measure that impact. The tendency to experience flow was chosen as a measure of engagement. Flow is a psychological state felt by people when they act with total involvement. People can experience flow when performing an engaging task. A high tendency to experience flow means high intrinsic motivation and a better engagement. The thesis addressed these issues by conducting an empirical study with primary education young
students. The study investigated if a social learning environment with gamification tools would be more able to increase students disposition to experience flow than a non-gamified version. In this experiment, some gamified learning activities were set following the guidelines of the proposed framework.

The results from the empirical study showed that there was an improvement in the students’ disposition for flow when using the gamified version of the social learning environment. The students’ average score had an increase and the statistical test taken allowed to conclude that the average score increase has statistical significance.
Contents

Autorización de Depósito iii

Acknowledgements v

Abstract vii

List of Figures xv

List of Tables xvii

Abbreviations xix

I Introduction 1

1 Motivation 3
  1.1 The Research Problem and Its Context 3
  1.2 Gamification: A New Trend 5
  1.3 Thesis Structure 7

2 Thesis Goals and Contributions 11
  2.1 Addressing the Problem 11
  2.2 Research Context 12
  2.3 Research Questions and Thesis Statement 14
  2.4 Research Goals and Contributions 16

II Background and State of the Art 21

3 Information and Communication Technologies in Education 23
  3.1 Learning with Technology 23
    3.1.1 E-learning 25
    3.1.2 B-learning 26
    3.1.3 M-learning 26
| Contents |
|-----------------|-----------------|
| 3.1.4 Learning Management Systems | 27 |
| 3.2 Social and Cultural Context | 27 |
| 3.2.1 Cultural Generations | 27 |
| 3.2.2 Digital Natives and Digital Immigrants | 29 |
| 3.2.3 Residents and Visitors | 29 |
| 3.2.4 Net Generation | 30 |
| 3.2.5 Gamers | 31 |
| 3.3 E-learning 2.0 | 31 |
| 3.3.1 Personal Learning Environments | 32 |
| 3.3.2 Social Learning Environments | 33 |
| 3.4 Summary | 33 |
| 4 Games and Learning | 37 |
| 4.1 Games | 37 |
| 4.1.1 What is a Game? | 38 |
| 4.1.2 Video Games | 40 |
| 4.1.3 Player Types | 40 |
| 4.1.4 Game Frameworks | 41 |
| 4.1.5 Social Games | 43 |
| 4.1.6 Pervasive Games | 44 |
| 4.1.7 “Gaming Can Make a Better World” | 45 |
| 4.2 Game-Based Learning | 45 |
| 4.2.1 Serious Games | 47 |
| 4.2.2 Simulations | 48 |
| 4.2.3 Virtual Worlds | 49 |
| 4.3 Summary | 49 |
| 5 Gamification Fundamentals | 51 |
| 5.1 The Concept of Gamification | 51 |
| 5.1.1 Origin and Evolution | 52 |
| 5.1.2 Definitions | 56 |
| 5.2 Gamification Categories | 58 |
| 5.2.1 BLAP Gamification | 58 |
| 5.2.2 Meaningful Gamification | 59 |
| 5.2.3 Implicit and Explicit Gamification | 60 |
| 5.2.4 Structural and Content Gamification | 60 |
| 5.2.5 Extrinsic and Intrinsic Gamification | 61 |
| 5.2.6 Internal, External and Behavior Change Categories | 61 |
| 5.3 Fields of Application | 62 |
| 5.3.1 Healthcare and Wellness | 63 |
| 5.3.2 Sustainability | 64 |
| 5.3.3 Enterprise and Business | 66 |
| 5.3.4 Self Improvement and Behavior Change | 68 |
| 5.3.5 Quantified Self | 69 |
| 5.3.6 Education and Training | 70 |
| 5.4 Application in Education and Training | 72 |
| 5.4.1 Gamifying the Classroom | 72 |
## Contents

5.4.2 Examples ............................................. 73

5.5 Gamification Frameworks .................................. 74
  5.5.1 GOLF .............................................. 75
  5.5.2 Werbach and Hunter ............................... 76
  5.5.3 Marczewski ......................................... 77
  5.5.4 Octalysis ........................................... 78
  5.5.5 Player’s Journey Framework ....................... 79
  5.5.6 Player Centered Design Methodology ............. 80
  5.5.7 Huang and Soman .................................. 81
  5.5.8 Other Approaches ................................ 82

5.6 Commercial Gamification Platforms ..................... 82

5.7 The Downside of Gamification ............................ 83

5.8 Summary ................................................. 85

6 Gamification and Psychology ................................. 87
  6.1 The Role of Motivation and Behavior Change .......... 87
  6.2 Intrinsic and Extrinsic Motivation .................... 88
  6.3 Self-Determination Theory ............................. 89
  6.4 Fogg Behavior Model ................................... 91
  6.5 Flow Theory ........................................... 93
    6.5.1 Elements of Flow ................................ 95
    6.5.2 Flow in Computer Environments .................. 96
  6.6 Motivation 3.0 ........................................ 99
  6.7 Motivation, Games and Gamification ................... 99
    6.7.1 Theory of Intrinsically Motivating Instruction .. 100
    6.7.2 RAMP .......................................... 101
    6.7.3 SAPS ........................................... 102
    6.7.4 RECIPE .......................................... 103
  6.8 Summary ................................................. 103

7 Research on Gamification .................................... 107
  7.1 Research Issues ....................................... 107
  7.2 General Research on Gamification ..................... 108
  7.3 Research on Gamification of Education ................ 109
  7.4 Empirical Studies on Gamification of Education ....... 110
  7.5 Summary ................................................. 112

III A Gamification Framework ................................. 113

8 Clarification of Concepts .................................. 115
  8.1 Introduction ......................................... 115
  8.2 What is Gamification, After All? ....................... 116
  8.3 What Gamification is Not ............................. 118
  8.4 What are Game Elements? ................................ 119
    8.4.1 Adopted Terms and Their Interpretation ........ 120
<table>
<thead>
<tr>
<th>Section</th>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.4.2</td>
<td>Which are the Most Used Game Elements?</td>
<td>122</td>
</tr>
<tr>
<td>8.4.3</td>
<td>How Rules Have Been Addressed?</td>
<td>123</td>
</tr>
<tr>
<td>8.5</td>
<td>What are Game Techniques?</td>
<td>125</td>
</tr>
<tr>
<td>8.5.1</td>
<td>Which are the Most Used Game Techniques?</td>
<td>126</td>
</tr>
<tr>
<td>8.6</td>
<td>What is a Game-like Engagement?</td>
<td>127</td>
</tr>
<tr>
<td>8.7</td>
<td>Who are the Players?</td>
<td>128</td>
</tr>
<tr>
<td>8.8</td>
<td>Which are the Target Behaviors?</td>
<td>129</td>
</tr>
<tr>
<td>8.9</td>
<td>What is a Gamified System?</td>
<td>130</td>
</tr>
<tr>
<td>8.10</td>
<td>What is a Gamification Framework?</td>
<td>132</td>
</tr>
<tr>
<td>8.11</td>
<td>Summary</td>
<td>133</td>
</tr>
<tr>
<td>9</td>
<td>GET7 Components</td>
<td>135</td>
</tr>
<tr>
<td>9.1</td>
<td>Core Concepts</td>
<td>135</td>
</tr>
<tr>
<td>9.1.1</td>
<td>Introduction</td>
<td>135</td>
</tr>
<tr>
<td>9.1.2</td>
<td>Challenge/Skill Balance</td>
<td>137</td>
</tr>
<tr>
<td>9.1.3</td>
<td>Autonomy &amp; Control</td>
<td>137</td>
</tr>
<tr>
<td>9.1.4</td>
<td>Feedback &amp; Rewards</td>
<td>138</td>
</tr>
<tr>
<td>9.1.5</td>
<td>Friends</td>
<td>138</td>
</tr>
<tr>
<td>9.1.6</td>
<td>Fun &amp; Flow</td>
<td>139</td>
</tr>
<tr>
<td>9.1.7</td>
<td>Core Concepts Relationships in GET7</td>
<td>140</td>
</tr>
<tr>
<td>9.2</td>
<td>Game Techniques</td>
<td>141</td>
</tr>
<tr>
<td>9.2.1</td>
<td>Clear and Intermediate Goals</td>
<td>143</td>
</tr>
<tr>
<td>9.2.2</td>
<td>Content Unlocking</td>
<td>143</td>
</tr>
<tr>
<td>9.2.3</td>
<td>Time Pressure</td>
<td>144</td>
</tr>
<tr>
<td>9.2.4</td>
<td>Fun Failure</td>
<td>144</td>
</tr>
<tr>
<td>9.2.5</td>
<td>Multiple Paths</td>
<td>145</td>
</tr>
<tr>
<td>9.2.6</td>
<td>Social Interactions</td>
<td>146</td>
</tr>
<tr>
<td>9.2.7</td>
<td>Virtual Economy</td>
<td>147</td>
</tr>
<tr>
<td>9.3</td>
<td>Game Elements</td>
<td>148</td>
</tr>
<tr>
<td>9.3.1</td>
<td>Point Systems</td>
<td>152</td>
</tr>
<tr>
<td>9.3.2</td>
<td>Badges</td>
<td>153</td>
</tr>
<tr>
<td>9.3.3</td>
<td>Leaderboards</td>
<td>156</td>
</tr>
<tr>
<td>9.3.4</td>
<td>Levels</td>
<td>158</td>
</tr>
<tr>
<td>9.3.5</td>
<td>Progress Bars</td>
<td>160</td>
</tr>
<tr>
<td>9.3.6</td>
<td>Social Graphs</td>
<td>161</td>
</tr>
<tr>
<td>9.3.7</td>
<td>Virtual Currencies</td>
<td>162</td>
</tr>
<tr>
<td>9.4</td>
<td>Summary of the Framework's Components</td>
<td>163</td>
</tr>
<tr>
<td>10</td>
<td>Reference Architecture for GET7</td>
<td>165</td>
</tr>
<tr>
<td>10.1</td>
<td>GET7 Reference Architecture</td>
<td>165</td>
</tr>
<tr>
<td>10.2</td>
<td>Dashboard</td>
<td>167</td>
</tr>
<tr>
<td>10.3</td>
<td>Player Profile</td>
<td>169</td>
</tr>
<tr>
<td>10.4</td>
<td>Analytics Engine</td>
<td>170</td>
</tr>
<tr>
<td>10.5</td>
<td>Gamification Engine</td>
<td>170</td>
</tr>
<tr>
<td>10.6</td>
<td>Activity Manager</td>
<td>172</td>
</tr>
<tr>
<td>10.7</td>
<td>Connections Manager</td>
<td>175</td>
</tr>
<tr>
<td>10.8</td>
<td>Summary</td>
<td>176</td>
</tr>
</tbody>
</table>
11 A Guide to Apply GET7 177
  11.1 A Guide to Apply Gamification ........................................ 177
  11.2 Context Characterization .............................................. 179
  11.3 Activity Goals ......................................................... 180
  11.4 Apply the 7 Game Techniques ........................................ 181
  11.5 Apply the 7 Game Elements ........................................... 182
  11.6 Set the Rules .......................................................... 183
  11.7 Deploy the Solution .................................................... 184
  11.8 Evaluate the Results ................................................... 184
  11.9 The Guide in Learning Settings ...................................... 185
  11.10 Summary ............................................................... 186

IV Thesis Validation 187

12 Schoooools: Gamification of a Social Learning Environment 189
  12.1 Shoooools: A Social Learning Environment ......................... 189
  12.2 Gamification of Shoooools ............................................ 192
  12.3 Summary ............................................................... 194

13 Measuring Flow and Engagement 195
  13.1 Student Engagement .................................................... 195
  13.2 Assessing Engagement ................................................ 196
  13.3 Measuring Flow ........................................................ 197
  13.4 The Dispositional Flow Scale-2 ...................................... 197
  13.5 Pilot-Test with the Dispositional Flow Scale-2 ..................... 199
  13.6 Summary ............................................................... 201

14 Experiment 203
  14.1 Gamification Guide Evaluation ....................................... 203
    14.1.1 Participants ....................................................... 204
    14.1.2 Procedure ......................................................... 204
    14.1.3 Survey’s Results ................................................ 205
    14.1.4 Qualitative Analysis ............................................ 205
  14.2 Controlled Experiment with Schoooools ........................... 206
    14.2.1 Experimental Design ............................................. 206
    14.2.2 Threats to Validity .............................................. 207
    14.2.3 Participants ....................................................... 209
    14.2.4 Procedure ......................................................... 210
    14.2.5 Running the Experiment ....................................... 211
    14.2.6 Experiment’s Results .......................................... 219
    14.2.7 Discussion ......................................................... 222
  14.3 Summary ............................................................... 225
### Contents

V Conclusions 227

15 Conclusions and Future Work 229
  15.1 Final Conclusions 229
  15.2 Topics for Future Research 231
  15.3 The Future of Gamification 232

A Flow State Scales 235

B Gamification Guide Survey 239

C List of Publications 247

D Resumen 249

Bibliography 263
List of Figures

1.1 How to Read This Thesis ........................................... 8
2.1 Research Work Overview .......................................... 15
2.2 A Framework for Social Gamification ............................ 17
3.1 ICT and Games Related Generations ............................... 34
4.1 Player Types: Social Action Matrix ............................... 41
4.2 The MDA Framework ............................................... 42
5.1 Gamification in the Gartner Hype Cycle (2011 to 2014) ....... 54
5.2 Gamification in the 2014 Gartner Hype Cycle ................. 55
5.3 Healthcare and Wellness Example: Nike+ ....................... 63
5.4 Sustainability Example: RecycleBank ......................... 66
5.5 Enterprise and Business Example: Samsung Nation ............ 67
5.6 Self Improvement and Behavior Change Example: Chore Wars . 69
5.7 Education and Training Example: Khan Academy .............. 75
5.8 Octalysis Framework Example ................................. 79
5.9 The Player Journey Framework ................................. 80
6.1 Fogg Behavior Model (FBM) ........................................ 92
6.2 Flow Model: Challenge/Skill Balance ......................... 94
6.3 Flow Framework for Empirical Flow Studies and the PAT model 97
6.4 Flow Factors in the Flow Framework ......................... 98
8.1 Example of a Rule Definition in a Gamification Platform .... 124
8.2 Example of a Rule Definition in GaML ........................ 125
8.3 Gamified Applications in Digital and Non-digital Contexts ... 131
9.1 Flow Model .................................................. 136
9.2 Game Techniques and the Flow Channel ...................... 142
9.3 Game Elements and the Flow Channel .......................... 149
9.4 UML Class Diagram for Game Elements ...................... 150
9.5 UML Class Diagram for Gamified Systems’ Users and Mediators 151
9.6 UML Class Diagram for Points .............................. 153
9.7 UML Class Diagram for Leaderboards ....................... 157
9.8 UML Class Diagram for Levels ................................ 160
9.9 Virtual Currency ............................................. 163
10.1 Architecture for a Gamified System: Package Diagram ....... 166
List of Figures

10.2 Gamified System: Use Cases ........................................ 167
10.3 Dashboard and Player Profile Class Diagram ...................... 169
10.4 Analytics and Activity Manager Class Diagram .................. 170
10.5 Gamification Engine Class Diagram ............................... 171
10.6 Activity Diagram for a Primary Rule .............................. 173
10.7 Activity Diagram for a Secondary Rule ............................ 174
10.8 Connections Manager Class Diagram ............................... 175

12.1 The SLE Schoooools ................................................. 190
12.2 Example of Activity in Schoooools: A Text with a Drawing ........ 191
12.3 The SLE Schoooools with Gamification Tools: Contexts of Use ... 192
12.4 Schoooools' Badges ................................................ 193

13.1 Pilot-test: Boxplots of DFS-2 Scores. .............................. 200
14.1 Reference Guide to Apply Gamification ............................ 213
14.2 Description of the Experiment's Gamified Activities .............. 215
14.3 Boxplots of DFS-2 Total Scores ................................. 221
14.4 Boxplots of Paired Flow Dimensions: Flow Antecedents ......... 223
14.5 Boxplots of Paired Flow Dimensions: Flow Outcomes .......... 224

A.1 Grant Permission for DFS-2 Use .................................. 236
A.2 DFS-2 Original Version - Five Sample Items ..................... 237
A.3 DFS-2 Portuguese Version - Five Sample Items .................. 237

B.1 Questionnaire for GET7 Guide Evaluation ........................ 241
B.2 Reference Guide to Apply Gamification (Portuguese Initial Version) ... 242
B.3 Respondents Gender ............................................. 243
B.4 Respondents Teaching Level ...................................... 243
## List of Tables

3.1 Cultural Generations ........................................... 28  
3.2 Games Generations ........................................... 32  
5.1 Gamified Learning Management Systems ......................... 73  
5.2 Gamification Tools for Education ................................ 73  
5.3 Gamification Platforms ........................................ 83  
6.1 SDT vs. RECIPE .................................................. 104  
8.1 Game Mechanics and Game Dynamics from Bunchball ............ 120  
8.2 Most Used Game Elements and Game Techniques .................. 134  
9.1 GET7 Framework’s Core Concepts ................................ 140  
9.2 Core Concepts vs. Game Techniques ............................. 142  
9.3 Primary and Secondary Game Elements ........................... 150  
9.4 Game Techniques vs. Game Elements ............................. 151  
11.1 Framework’s Reference Guide .................................. 179  
11.2 Game Elements and Game Techniques ........................... 183  
13.1 Pilot Test: Scores of the DFS-2 Dimensions ..................... 199  
14.2 Experiment: Missions’ Points and Levels ....................... 217  
14.3 Pre-Test: Scores of the DFS-2 Dimensions ..................... 220  
14.4 Post-Test: Scores of the DFS-2 Dimensions .................... 220  
14.5 DFS-2 Total Scores: Paired Differences ........................ 221  
14.6 Experiment’s Parameters and Results ........................... 222
Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>3F</td>
<td>Friends, Feedback and Fun</td>
</tr>
<tr>
<td>BLAP</td>
<td>Badges, Levels, Leaderboards, Achievements and Points</td>
</tr>
<tr>
<td>CME</td>
<td>Computer Mediated Environment</td>
</tr>
<tr>
<td>COTS</td>
<td>Commercial Off-the-Shelf</td>
</tr>
<tr>
<td>CRM</td>
<td>Customer Relationship Management</td>
</tr>
<tr>
<td>DFS-2</td>
<td>Dispositional Flow Scale–2</td>
</tr>
<tr>
<td>DGBL</td>
<td>Digital Game–Based Learning</td>
</tr>
<tr>
<td>DSL</td>
<td>Domain–Specific Language</td>
</tr>
<tr>
<td>ESM</td>
<td>Experience Sampling Method</td>
</tr>
<tr>
<td>FBM</td>
<td>Fogg Behavior Model</td>
</tr>
<tr>
<td>FSS</td>
<td>Flow State Scale</td>
</tr>
<tr>
<td>GaML</td>
<td>Gamification Modeling Language</td>
</tr>
<tr>
<td>GBL</td>
<td>Game–based Learning</td>
</tr>
<tr>
<td>GET7</td>
<td>7 Game Elements and 7 Game Techniques</td>
</tr>
<tr>
<td>GWAP</td>
<td>Games With A Purpose</td>
</tr>
<tr>
<td>HCI</td>
<td>Human Computer Interaction</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communication Technologies</td>
</tr>
<tr>
<td>ILE</td>
<td>Interactive Learning Event</td>
</tr>
<tr>
<td>IS</td>
<td>Information System</td>
</tr>
<tr>
<td>K-6</td>
<td>Kindergarten to 6th grade (preschool and elementary education)</td>
</tr>
<tr>
<td>K-12</td>
<td>Kindergarten to 12th grade (preschool to secondary education)</td>
</tr>
<tr>
<td>KPI</td>
<td>Key Performance Indicator</td>
</tr>
<tr>
<td>LMS</td>
<td>Learning Management System</td>
</tr>
<tr>
<td>MDA</td>
<td>Mechanics, Dynamics and Aesthetics (games’ framework)</td>
</tr>
<tr>
<td>MDA</td>
<td>Model Driven Architecture (framework based on UML)</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>MMORPG</td>
<td>Massive Multiplayer Online Role Playing Game</td>
</tr>
<tr>
<td>MOOC</td>
<td>Massive Open Online Course</td>
</tr>
<tr>
<td>MUD</td>
<td>Multi-User Dungeon</td>
</tr>
<tr>
<td>OBI</td>
<td>Mozilla Open Badge Infrastructure</td>
</tr>
<tr>
<td>PAT</td>
<td>Person–Artefact–Task Model</td>
</tr>
<tr>
<td>PBL</td>
<td>Points, Badges and Leaderboards</td>
</tr>
<tr>
<td>PIM</td>
<td>Platform Independent Model</td>
</tr>
<tr>
<td>PLE</td>
<td>Personal Learning Environment</td>
</tr>
<tr>
<td>QS</td>
<td>Quantified Self</td>
</tr>
<tr>
<td>RAMP</td>
<td>Relatedness, Autonomy, Mastery and Purpose</td>
</tr>
<tr>
<td>RECIPE</td>
<td>Reflection, Exposition, Choice, Information, Play and Engagement</td>
</tr>
<tr>
<td>RPG</td>
<td>Role–Playing Game</td>
</tr>
<tr>
<td>SAPS</td>
<td>Status, Access, Power and Stuff</td>
</tr>
<tr>
<td>SDT</td>
<td>Self-Determination Theory</td>
</tr>
<tr>
<td>SLE</td>
<td>Social Learning Environment</td>
</tr>
<tr>
<td>SNS</td>
<td>Social Network Site</td>
</tr>
<tr>
<td>SP</td>
<td>Social interaction Points</td>
</tr>
<tr>
<td>UML</td>
<td>Unified Modeling Language</td>
</tr>
<tr>
<td>URL</td>
<td>Uniform Resource Locator</td>
</tr>
<tr>
<td>WWW</td>
<td>World Wide Web, or Web for short</td>
</tr>
<tr>
<td>XP</td>
<td>EXperience Points</td>
</tr>
</tbody>
</table>
To my Family, Zi, Marta and Miguel
Part I

Introduction
Chapter 1

Motivation

1.1 The Research Problem and Its Context

Student disengagement is a global world problem in most of the developed countries. Shernoff et al. (2014) point to 20% to 25% of students in 28 OECD\textsuperscript{1} countries classified as having low participation and/or a low sense of belonging. The disengagement problem crosses all education levels. Education faces a crisis of engagement (Stokes, 2014).

Boredom and apathy in class have been pointed as primary reasons that many students do not become engaged in school learning (Huang and Soman, 2013; Shernoff et al., 2014). These reasons lead to drop-outs, low performance, absentism and failing classes (Shernoff et al., 2003). In part, the lack of engagement can be due to the fact that students today are distracted by technology such as smartphones and the Internet (Huang and Soman, 2013). Motivation and engagement are critical issues for the completion of a task or encouragement of a specific behavior, therefore, also critical issues for students’ success.

Students today live in a world where the rapid evolution and spread of digital technology is a historical singularity. Widely accessible and present in the daily activities, the degree of dependence on technology in developed societies is increasingly high. Information and Communication Technologies (ICT) play now a major role in the lives of most people, particularly in developed countries, but also, in more or less extent, globally in the whole world. In this context, the younger generations are technology consumers and are familiar with the language of video games, the kind of games that can be played on a computer, a smartphone or a tablet computer.

\textsuperscript{1}Organisation for Economic Co-operation and Development
Chapter 1. Motivation

Reporting to 2008 (Livingstone and Haddon, 2009), 75% of children in European Union (EU) countries, between 6 and 17 years old, were Internet users. More recent studies (Mascheroni and Ólafsson, 2014), on how young people use the Internet in some EU countries, revealed that, on average, these young users access the Internet in a daily basis and mainly from home (74%), the main context of Internet use. Only 21% of them use the Internet at school (the third most common context of Internet access and use). The average age of first Internet use is dropping, being around 8 years old in 2014. Desktop and laptop computers, mobile phones, smartphones and tablet computers are the most popular devices to access the Internet. According to another recent study (Livingstone and Haddon, 2014), children and teenagers from 9 to 16 years old are more likely to engage with social network sites (63%), instant messaging (49%), online videos (59%) and playing games with others on the Internet (28%).

The reality of the United States of America is similar. A study reporting to data collected in 2009 (Rideout et al., 2010), reveals what was the media exposure of the country’s population aged between 8 and 18 years old. One result of this study points to an exposure of more than 7.5 hours daily (7 days a week) to different media (television, music and audio, computer, electronic games, films and printed documents). Multitasking capabilities of young people with the simultaneous use of more than one media at the same time increases the daily exposure to an average of more than 10 hours.

In this digital context, video games have an important share. The number of people that play video games increased in recent years and gamers’ average age also raised. A study from the Entertainment Software Association (Johnson et al., 2014a), reveals that the average age of today’s gamers is 30, with 68% of gamers over 18 years old. The Entertainment Software Association, according to Schifter (2013), also reported that, by 2011, 72% of American households play computers. Schifter also observed that “nearly every teen plays games in some way”. The popularity of digital games has led to a rapid development in the video game industry over the past decade, with considerable advances that have broadened the definition of games and how they are played (Johnson et al.).

In developed countries, digital technologies are part of most people lives, from the early childhood. But this collides with the reality of the classroom where the technology gap with the outside world has become ever larger. For students used to living with technology, a classroom is an old-fashioned place. Educators did not ignore this reality and ICT are being used in education for several years with different approaches, including the use of games. However, educators are still looking for the best learning strategies to teach with digital technologies. Teaching with technology did not solve completely
the engagement problem and schools are still facing difficulties concerning student motivation and engagement (Domínguez et al., 2013; Huang and Soman, 2013; Lee and Hammer, 2011). Also, e-learning systems, that will be discussed in Chapter 3, did not have the impact that many believed was possible (Charles, 2010).

The research problem’s identification – students’ disengagement – and its contextualization – students living in a world full of digital technologies that are also gamers or, at least, familiar with the video games’ aesthetics – were the starting points for the research work presented in this thesis.

In summary, today’s schools, although trying to keep the pace with digital technologies, deal with disengaged students. Students are deeply involved with digital technologies outside school, and many of them play video games on their computers, smartphones or tablets. Although these two realities seem to be incompatible, the second one could help to solve the first, if educators look at digital technologies and video games not as a threat but as an opportunity to get more motivated students.

1.2 Gamification: A New Trend

By the end of 2010, a new concept was spreading on digital media named by a strange word: gamification. What then is gamification? Despite further considerations made in this thesis in the following chapters, gamification is a way to make non-game contexts look like games. How is this achieved? By using game design elements and game techniques from games in general and, in particular, from video games. Why is this trend relevant? Because games are engaging and motivating. If players are deeply attracted by games then, by inducing a game-like engagement in a non-game context, it will be possible that people in that context get the same levels of engagement and motivation. This is what gamification is for: to get people change their behaviors in order to be more loyal to a brand or to a service, to be more motivated to perform a task that they were not willing to do, or to improve their habits regarding a healthier life or a more sustainable society. Games can teach application designers and developers how to better achieve these goals.

But, are the ideas behind this concept new? No, no at all. Enterprises’ customers loyalty programs use, for a long time, ways of rewarding their customers for their actions. Examples are the points systems, similar to those used in games, to record customers’ interactions with a brand or product. Even schools have always used points, levels and badges (although known by different names). Points, levels and badges are common
game elements that are also used by most of the applications and services that follow the gamification approach.

Since the ideas behind gamification are not new, **why now?** What was the reason for this trend, named by an awkward neologism, to emerge just a few years ago? There are many reasons to explain that. Video games reached a plateau of notoriety that compete and overpass other popular entertainment industries, like the movies industry. A whole generation of people that grew with video games and digital technologies is now finishing school and the oldest of them are already in the labour market (Prensky, 2007).

The rise in Internet use, the emergence of the Web 2.0 that changed the way people use the Internet and the World Wide Web (WWW), moving from a passive role to a more active one, also helps to explain the origin of the gamification trend. Social casual games, brought by some of the most popular Web 2.0’s applications, the Social Network Sites (SNS) brought new types of gamers and changed the way people play video games, to a more casual, ubiquitous and social way. The importance of social games to the rise of gamification is highlighted by Hamari and Eranti (2011):

> Services have always been gamified (e.g. loyalty programs and serious games) however the new wave of gamification is sort of a novel realisation of the variety of possibilities it potentially offers. This new wave has been particularly initiated by the success of social games and social online networks. (p. 17)

Therefore, gamification is founded in both technological and social grounds. The ICT evolution, which lead to the extensive use of mobile devices connected to large bandwidth networks, along with the way people started to use those technologies, were major drivers for the emergence of this new concept.

As the word gamification spread in digital media and several gamified applications became popular, some enthusiastic predictions were made about the success and adoption of the concept. In 2012, Gartner, an information technology research and advisory firm, stated that, by 2015, 40% of the world’s largest 1,000 organizations are expected to apply gamification to transform their business operations. Although, by the end of 2014, the actual penetration of gamification was just 5% to 10% (Kapp, 2015). The exaggerated optimism about the power of gamification has caused many people criticized the concept and its applicability. Gamification has its most loyal fans amongst marketers and digital consultants and the worst enemies amongst many games studies academics and game designers. The first ones, use it mostly as a buzzword, often without proper knowledge of how to apply it. For gamification detractors, gamification is a misunderstanding of the core principles of game design (Tulloch, 2014).
Despite the academic debate about the validity of the concept, gamification has already proven in many different areas. Since the hype around it started, education was pointed as one of the most promising areas to apply this concept (Lee and Hammer, 2011). The main focus is on the potential for gamification to change and improve the students’ behavior towards better chances of success: “gamification in education can be a powerful strategy when implemented properly, as it can enhance an education program, and achieve learning objectives by influencing the behaviour of students” (Leong cited by Huang and Soman, 2013, p. 24). Therefore, since gamification is about behavior change and engagement and schools face an engagement crisis, despite all the efforts made to use ICT, gamification could make a contribution to solve this crisis. Some initial exploratory questions arose: How to apply gamification in technology-enhanced learning contexts? How can it help educators and schools to get more engaged students?

1.3 Thesis Structure

This thesis is organized as shown in Figure 1.1 that highlights the most important contributions of each chapter.

In Part I, the present chapter, summarizes the motivation for this thesis, explaining how this research work started, what is the problem that motivated the research - students’ disengagement - and points gamification as a new trend that can make a contribution to solve the problem. This first chapter also describes the thesis structure and how to read it. How the research problem was addressed and the problem’s context is explained in Chapter 2. A psychological state, known as the flow state, is introduced in this chapter and pointed as a measure for student engagement. The research questions, the research goals, and the thesis statement are also presented in this chapter along with the thesis contributions.

Part II describes the state of the art on gamification and includes some background on related topics. Part II starts with a further development about the problem context (Chapter 3), regarding the use of ICT in education, particularly, e-learning, and the impact of the Web 2.0. A background about games and digital games and their relation to education is presented in Chapter 4. Chapter 5 explains in detail the main concept of the thesis. It starts with the origin and evolution of the concept and discusses several issues regarding its use. Some examples and applications are also provided as long as some frameworks and software platforms. Chapter 6 gives some background on psychology motivation theories that are fundamental to the understanding of the thesis.
Part III details and describes the main thesis contribution - a gamification framework named as GET7 (7 Game Elements and 7 Game Techniques). Part III begins with Chapter 8 that clarifies some concepts used along this thesis that are essential to understand the underlying research work. Some key terms like game elements, game techniques and rules are clarified as a first contribution of this thesis. Another important contribution presented in this chapter is about the identification of the most used game elements and game techniques, found in the thesis literature review and in the analysis.
of several existing gamified applications. Chapter 9 presents the framework’s core concepts and the chosen game elements and game techniques. Chapter 10 describes the proposal of an architecture for gamified systems, considering the core concepts, game elements and game techniques from the previous chapters. Chapter 11 concludes this third part of the thesis describing the proposal of a guide that a gamification designer should follow in order to develop gamified activities, using the framework’s elements and techniques and supported by a software platform in accordance to the proposed architecture.

Part IV concerns the thesis validation. It starts with Chapter 12 that describes the chosen validation platform for the contributions of the thesis, the Schoooools Social Learning Environment. Chapter 13 introduces the adopted methodology to measure student’s engagement, the Dispositional Flow Scale-2. This part concludes with Chapter 14 describing the experiment taken to validate the thesis statement and presents the experiment’s results.

The last part of the thesis, Part V, includes a chapter for the conclusions (Chapter 15), summarizing the contributions, and pointing some issues to be addressed by future research.

Appendix A includes the questionnaires used in the experiment, the Flow State Scales. Appendix B includes a survey used to test the framework’s guide and Appendix C present the author’s list of publications. Finally, Appendix D is an extended abstract of the thesis (Resumen) in Spanish. The document ends with the thesis’s bibliography.
Chapter 2

Thesis Goals and Contributions

2.1 Addressing the Problem

The problem that motivated this thesis was previously described as a crisis in students’ motivation and engagement in today’s schools. Students belong to a generation commonly known as “digital natives” (Prensky, 2001). They are used to live with ICT in their daily lives but schools do not always provide the proper technological support in their learning activities.

Why is the disengagement problem important? Studies have consistently highlighted the important relationship between engagement and learning, with students who are highly motivated being more likely to engage in the learning process. Engagement is the extent of a student’s participation in learning activities (Charles, 2010). Engagement with academic activities is seen as a predictor of a student’s long and short term academic achievement.

Can games and gamification make a contribution to solve the problem? In the education sector, the power of games was known for a long time. Games are known to be highly engaging. Game-Based Learning (GBL), the use of games in education, started long before gamification. The advantages of the use of video games in education or Digital Game-Based Learning (DGBL), was pointed by several scholars and academics like James Paul Gee (Gee, 2005). A connection between learning and play is also known for a long time. The word “pedagogy” came from the Greek word “paidagogia”. The terms “paideia”, a word used for education, “paidia” a word used for play and games, and “paides”, the word for children, have all the same etymological root (Krentz, 1998). In the ancient Greek culture, learning was a form of play.
But GBL and DGBL have some implementation issues in schools that reduce their impact. Gamification can be seen as an alternate approach to GBL and DGBL. This new approach does not use full fledged games but instead it uses the game components and techniques that are able to produce the same levels of engagement found in people when playing games. As gamification deals with motivation and behaviors, positive psychology theories are also part of the concept grounds. Hence gamification can also be seen as a concept in the crossroads of games, technology and psychology.

Johnson et al. (2014b) identified games and gamification as part of the digital strategies that will drive technology for K-12 education (K-12 means “kindergarten to 12th grade” and is a term used in English-speaking countries and some other countries to designate kindergarten, primary and secondary education). These digital strategies are ways of using devices and software to enrich teaching and learning, in the classroom or outside the classroom. These authors observed that gamification “although still in its nascent stages in education, the gamification of learning environments is gaining support among educators who recognize that effectively designed games can stimulate large gains in engagement, productivity, creativity, and authentic learning” (p. 38). Johnson et al. also stated that “gamified learning environments in practice can motivate learners to engage with subjects in an emotionally stimulating way” (p. 39). Other authors also point the benefits of gamification in learning environments (Huang and Soman, 2013):

In a traditional learning environment, a student’s motivation to learn effectively can be hindered due to a number of reasons. However, with the successful application of suitable gamification techniques, the delivery of the information can transform a simple or mundane task into an addictive learning process for the students. (p. 24)

Dicheva et al. (2015) also states that “the ‘gamification’ approach suggests using game thinking and game design elements to improve learners’ engagement and motivation” and Codish and Ravid (2014) claim that “gamification in education is being used as way to increase student engagement and learning”.

2.2 Research Context

Although there is for some time a lot of debate about how to use ICT in education, recent trends contribute with new issues. Social applications brought by the Web 2.0, the increasing interest of using games, simulations and virtual worlds in education and training (see Section 4.2) and the emerging concept of gamification established a set of
conditions that created the context for the developments of the thesis’ research work. These conditions can be summarized as follows:

- Existence of a generation of individuals commonly known as digital natives that has always lived with ICT and that are also gamers;
- Digital natives are also familiar with the use of SNS and other Web 2.0 social applications;
- Digital natives are considered to have a lack of motivation and engagement concerning school activities;
- Although teachers are already using ICT, they are still seeking the appropriate ways to use these technologies, and to adapt to new technological and social realities;
- Video games have an increasingly larger role in entertainment, but its influence reached many different areas, namely education;
- Games and video games have been used in education for quite some time, but recently the DGBL approach has gained notoriety;
- The recent trend known as gamification appears to be of value by improving motivation and engagement and inducing behavior change.

The research problem was addressed by finding out if, applying gamification in technology-enhanced learning settings, students’ engagement and motivation would increase. In this thesis, the tendency of experiencing flow was used as a measure of students’ engagement. Flow (Csikszentmihalyi, 1975), detailed in Section 6.5, is a psychological state that results of an engaging task. Flow occurs when a person is totally involved in the task at hand. The state of flow is often experienced by people when playing games.

In contexts related to human behavior and computers, flow has been studied in human-computer interaction, video games, instant messaging, mobile technologies, web sites, and game-based learning (Hamari and Koivisto, 2014). Flow has also been related to learning and academic achievement (Shernoff et al., 2014). According to Shernoff et al., engagement in learning is higher when components of flow, like concentration, interest and enjoyment are simultaneously stimulated. Issues concerning the measurement of flow are addressed in Chapter 13. Flow plays a fundamental role in this thesis’ contributions and is one of the core concepts included in the framework proposed as the main contribution (see Section 9.1.6).
2.3 Research Questions and Thesis Statement

As stated by Easterbrook et al. (2008), in a research early stages, researchers usually need to ask exploratory questions. In fact, this thesis’ research work raised some initial questions, as mentioned in Chapter 1. The research work evolution implied a review of those initial vague questions that lead to a more refined and precise versions. The choice of a Social Learning Environment (SLE, see Section 3.3.2) for field tests and the adoption of flow as a measure for engagement implied the questions refinement. Hence, the thesis statement emerged from the following research questions:

1. What is an effective way to use social gamification to improve students’ engagement in a Social Learning Environment?

2. Does a gamified Social Learning Environment cause a higher students’ disposition to experience flow than a non-gamified Social Learning Environment?

Following the research questions, the thesis statement is:

The use of a social gamification approach in a Social Learning Environment (SLE), applying good learning principles found in good games and supported by a proper framework, can foster students’ motivation and engagement by increasing their tendency to experience flow.

The first question is a design question (Easterbrook et al., 2008), concerning a better way to build a system. The second question is a causality-comparative question to investigate relationships between two different causes (does X causes more Y than Z).

This thesis proposes a gamification framework to endorse the first question. Gee (2005) had already raised the question as a research issue to be addressed:

So the suggestion I leave you with is not “use games in school” - though that’s a good idea - but: How can we make learning in and out of school, with or without using games, more game-like in the sense of using the sorts of learning principles young people see in good games every day when and if they are playing these games reflectively and strategically? (p. 11)

The thesis statement addresses Gee’s suggestion, making learning more game-like, “without using games” but by the use of game elements and game techniques in an existent SLE – Schoooools (see Chapter 12) – that helps learning “in and out of school”.
The application of the framework in an existent SLE will allow field tests to evaluate its effectiveness, trying to answer the second question. Lee and Hammer (2011) already highlighted the need to evaluate gamification benefits and drawbacks: “Intuition suggests that gamification may be able to motivate students to learn better and to care more about school. Making the case for gamification, however, requires more than intuition.”
Regarding the research questions, it is mandatory to understand the meaning of the more specific concept of social gamification. Seaborn et al. (2013) define social gamification as “an emerging subgenre of gamified systems that use game mechanics and elements from social games, which feature interactions designed for close peers and direct ties to social networking systems, in which they are often embedded” (p. 108). The definition for social gamification adopted in this thesis will be presented in Section 8.2.

Figure 2.1 shows an overview of the research work evolution that lead to the thesis statement. The research problem was addressed by trying to find how gamification could make a contribution solving it. Digital technology-enhanced learning settings, generically called as e-learning, were considered as the settings to apply gamification. Along the research, the concept of flow, as a way to measure students’ engagement, was chosen. Social games’ features were also considered. Social games and Web 2.0 trends lead to Social Learning Environments as appropriate e-learning settings to implement gamification. The preliminary research work and literature review found which were the most used game elements and techniques in those settings. From this initial work, the research questions were stated. Having the research questions established, the final goals and the thesis statement were then defined. Finally, a field experiment was set to validate the thesis statement.

### 2.4 Research Goals and Contributions

The research goals of this thesis can be summarized as follows:

1. To propose a framework and a set of guidelines to build gamified systems in order to improve not only the extrinsic motivation of players but also to make the gamified experience meaningful in a long term basis;

2. To define which game elements should be considered within the framework, how they must be applied, how they relate to each other and how they are related to the game techniques;

3. To define the framework’s supporting architecture, suited for the development of gamified systems;

4. To evaluate and validate the proposed framework in a real scenario (the SLE Schoooool).

After stating the research goals, the main contribution of this thesis is
a framework for social gamification, that includes a reference architecture to assist the design and implementation of gamified software systems and a guide to apply the concept in a non-game context.

Figure 2.2 depicts the main contribution, the underlying relation to the flow theory and the thesis validation methodology implemented by the experiment described in Chapter 14. The proposed social gamification framework, applied in an educational setting, intends to set up gamified learning activities. The framework’s game elements and game techniques will create the flow antecedents that lead to an optimal learning experience. The presence of these antecedents means that students will be more likely to experience flow while performing the learning activity. The consequences of such an experience are already known and proved by previous research. Students will be deeply engaged with the activity, and they will have an increase in their learning process. Therefore, the experiment will try to prove that students will increase their disposition to experience flow while performing a learning activity within the gamified SLE. If so, the flow consequences will arise.

**Figure 2.2: A Framework for Social Gamification in Education.**

The framework is of general purpose but will be given a special focus to its application in education. A detailed description of these contributions is given in Chapters 9, 10 and 11. The framework is intended to help gamified applications’ designers and developers to understand what components this kind of applications should include, how they are
related and how they could be effectively used. The proposal follows previous work about the main features that a gamification framework should include (Simões, 2012). Recent research shows that, as gamification is a new academic topic of study, there are few well-established theoretical frameworks (Hamari et al., 2014). A recent survey also points for the lack of gamification-specific frameworks highlighting this topic as a research issue:

One finding of our review of theoretical papers showed that while there was some consensus among theorists on foundational underpinnings, there was a lack of consensus on proposed gamification-specific frameworks. Further, to the best of our knowledge, the proposed gamification-specific frameworks have not been explored through applied research. Future research could determine their applicability and consolidate these frameworks if necessary. (Seaborn and Fels, 2015, p. 29)

The proposed framework was named as GET7. GET stands for Game Elements and Game Techniques. The number 7 represents the number of game elements and game techniques included in the framework. The framework’s guide also have 7 steps. Why 7? The number 7 is considered in some cultures with a mistic meaning. But there were more reasons related to the context of the work presented in this thesis. A more practical reason was the necessity to include a reasonable and feasible number of elements and techniques. Considering a large number of these elements would be confusing and would increase the framework’s complexity. Instead, the most cited and found elements in empirical studies were chosen. The number 7 was also inspired in an anecdotal comment made by Seth Priebatsch, the founder of SCVNGR, a social location-based gaming platform (deactivated since 2012): “(...) in SCVNGR we like to joke that with seven game dynamics, you can get anyone to do anything”¹.

Besides the main contribution of this thesis, presented on the previous section, along the research work, other contributions arose. The thesis reveals a more holistic vision of the concept of gamification that includes technical issues (e.g. the architecture for gamified systems) framed by psychology theories. The GET7 framework relies on some of those theories that are commonly referenced in the gamification literature. As Seaborn and Fels (2015) point, the large majority (87%) of applied gamification research does not mention or address theoretical foundations. Therefore, how the researched theoretical foundations relate to each other and how psychology theories can be used to build gamified computer environments, highlighting how technology should be properly used, is another contribution.

¹http://www.ted.com/talks/seth_priebatsch_the_game_layer_on_top_of_the_worldtranscript
Gamification literature is pointed as not having a very high scientific level (Kleij, 2014). Most of it is written in a general way. Also Hamari et al. (2014) claim that there are few well-established unified discourses concerning gamification. This thesis also aims a contribution to a more unified discourse regarding some gamification terms. Finding which were the most used game elements and game techniques in existing gamified applications is another contribution. The initial literature review showed also that there are several definitions for the concept of gamification and the thesis proposes a definition for gamification and also provides more specific definitions for gamification of education and for social gamification.

Several authors, like Kleij (2014), point to a lack of academic evidence of the benefits of gamification. Another important and final contribution of this thesis concerns empirical research about the use of gamification in a learning setting.

These other contributions can be summarized as follows:

- A clarification of what are game mechanics or rules, game dynamics, game elements, and game techniques (Section 8.4.1);
- An identification of the most used game elements and game techniques in learning settings (Sections 8.4.2 and 8.5.1);
- A proposal of a definition for general gamification, gamification of education and for social gamification (Section 8.2);
- A contribution for the empirical research about the use of gamification in technology-enhanced platforms (Chapter 14).
Part II

Background and State of the Art
Chapter 3

Information and Communication Technologies in Education

This chapter presents a background on the use of Information and Communication Technologies in education to what become known as e-learning. The origin and evolution of e-learning and their different approaches is also described along with a reference to some digital tools used in e-learning. The impact of the Web 2.0 on these forms of electronically aided learning and teaching is also addressed leading to more recent concepts like the Personal Learning Environments and the Social Learning Environments that are part of what is known as e-learning 2.0. All of these concepts concern a generation of students that have a close connection to digital technologies and the chapter also addresses the social and cultural contexts that shape today’s generation of students. This background is relevant to this research work because the framework proposed in the present thesis is applied in a Social Learning Environment for young students.

3.1 Learning with Technology

The technological evolution in the past one and a half century have been influencing the way people learn. The industrial revolution and the resulting social progress improved the living conditions of an increasingly urbanized population. This progress in most people’s lives brought a greater interest in individuals to improve their cultural levels and to develop new skills. Alternatives to the traditional formal learning systems started to appear in the 19th century, like distance learning systems. The first distance learning systems were mainly correspondence courses where students received contents and learning materials through postal mail. Distance learning benefited from the progress
occurred in postal services and communication routes that facilitated and accelerated the exchange of correspondence.

The subsequent evolution of these early forms of distance learning went along with the evolution of the media that suffered a sharp acceleration in the 20th century. The widespread of radio, television and videotext, audio and video cassettes, the increase in computer use, the appearance of the compact disc (CD) and other forms of information delivery, made a significant contribution to the growth and improvement of distance learning systems.

Regarding the use of Information and Communication Technologies (ICT) in education, the Internet played a major role. Its origins date back to the second half of the last century but the great explosion of the Internet occurs in 1990 with the launch of the World Wide Web also known by the acronym WWW, W3 or simply Web. Throughout the rest of the century, there has been an exponential growth of Internet use. The Internet is no longer restricted to the academic world but also started to be present in the business world and also with the possibility of home access.

ICT contribute significantly with new tools available to the school. The evolution of the Internet, the emergence of the Web and the increase in the use of computer technology in schools created a setting in which interactive digital technologies play an important role. Teachers and educators, but also policy makers, started to recognize the importance of digital technologies in education.

ICT suffer a new significant impact in the middle of the first decade of this century. New Web applications and a more active participation of users gave rise to the Web 2.0. The Web 2.0 is defined by O’Reilly (2005) as

the network as platform, spanning all connected devices. Web 2.0 applications are those that make the most of the intrinsic advantages of that platform: delivering software as a continually-updated service that gets better the more people use it, consuming and remixing data from multiple sources, including individual users, while providing their own data and services in a form that allows remixing by others, creating network effects through an ‘architecture of participation’.

According to Tapscott and Williams (2010), the Web now makes everyone a publisher and enables people to collaborate and to learn collectively. The Web 2.0, by providing a platform for networking human minds, enables a global networked intelligence.

Web 2.0 brought a new way to view and use ICT. Web 2.0 enabled users to share contents easily and collaborate in their creation (becoming producers), whereas previously
users were just consumers, limited to passively access contents created by others. The most popular examples of Web 2.0 applications are wikis, blogs, social networks sites and content sharing sites (videos, music, software, etc). The Web, by enabling the active involvement of users in producing and sharing their content, has quickly become an open space for users collaboration and socialization. Users can self-organize into networks and virtual communities. Web 2.0 can be viewed as a platform that provides services to communities of users. These communities are made of people who share information and experiences, interact collaboratively, for recreational, professional and personal enrichment. The information increases its value through the sharing and contribution of several users. The increasingly weight of ICT in modern societies gave rise to new technology-enhanced learning systems. With these systems, people can now learn not only in schools or in other formal educational and training institutions, but they can also learn informally out of school. Learning is no longer confined to a particular period in life but instead, people can continue to learn throughout their lives. It is also possible to learn being physically apart from the teacher or trainer and apart from other learners, but still be able to communicate and collaborate with them.

The impact of the use of ICT in education in recent years and some insights about what the future can bring can be found in Johnson et al. (2012, 2014a,b).

3.1.1 E-learning

The use of ICT, particularly the Internet, in distance learning systems resulted in what is usually referred as e-learning (electronic learning). The application of the term depends on the organization using it, the means and technologies involved but, essentially, it has been designating learning systems that use electronic means without contact and physical proximity between teachers and students. The concept has evolved, moving away from the simple connotation with distance education to designate the use of various technological tools in education, in particular those related to ICT. Either as an aid to teaching in a traditional face-to-face classroom, either in distance learning systems, or also in mixed scenarios, e-learning is now inseparable from teaching. This notion of what e-learning is can be found in the definition proposed by the European Union: “the use of new multimedia technologies and the Internet to improve the quality of learning by facilitating access to resources and services as well as remote exchanges and collaboration”\(^1\).

\(^1\)http://ec.europa.eu/information_society/eeurope/2005/all_about/elearning/index_en.htm
The e-learning approach is based in digital technologies and online environments, that mediate the learning process, and break time (allowing for synchronous and asynchronous interactions) and space (allowing for distant interactions) barriers.

A recent trend in e-learning are the new Massive Online Open Courses (MOOC). These are online courses designed for a large number of learners and open, meaning that they are free. Most of the times, MOOC’s students cannot interact with teachers or tutors. Contents are lighter and its access is user-friendly. The courses are mostly based in video and audio contents with online questionnaires that give immediate feedback about the students progress.

Although these recent developments, e-learning systems are still criticised for failing to engage users.

### 3.1.2 B-learning

The concept of b-learning (blended learning) is a variant of e-learning where distance learning is complemented with classroom learning with sessions where teachers meet physically with students. B-learning is mainly a combination of Internet and digital media contents, where instruction is computer-mediated, with traditional classroom instruction requiring the physical co-presence of teacher and students. B-learning approaches combine tools from the face-to-face classroom with digital online and offline tools.

### 3.1.3 M-learning

The spread of wireless networks and different forms of Internet access, increasingly diverse, brought one step forward in the evolution of e-learning. Increasing bandwidth facilitates the combination of different media (text, sound and video). With new and easily available mobile devices, like tablet computers, laptops and smartphones came an opportunity to use these devices in education. This form of learning is referred to as m-learning (mobile-learning). Unlike traditional e-learning systems, m-learning does not imply the physical presence at a specific location, to access the devices needed for the teaching/learning process occur. With m-learning technologies, a learner is allowed to learn anywhere and at anytime. Internet accessibility facilitates instant communication with other learners. Location-based technologies, available in many mobile devices, allow the access to contents relevant to the specific location of the learner. The use of mobile technologies in education impacts on student motivation, improves collaboration among the students and increases student mobility (Abrantes, 2011).
3.1.4 Learning Management Systems

E-learning, as seen in the previous sections, comprises different ways to access learning and study materials throughout the use of computers, mobile devices and communication networks. This has been traditionally done through the use of specific software tools, the Learning Management System (LMS). A LMS allows also the management of a set of other e-learning tools. A LMS can be understood as an online platform for the installation and operation of education courses or training programs. Essentially, the platform is used by the teacher or trainer, who provides and manages content, and the students, who access such content. A LMS can offer several features like the ability to customize according to different usage profiles. Other features can be centralized management of multiple courses or materials, features to evaluate the work and progress of the students or features to allow for online collaboration. A LMS can be used in general e-learning but also in m-learning and m-learning settings. One of the best known and widespread LMS is Moodle\(^2\), an open-source platform.

3.2 Social and Cultural Context

The latest generations of children, commonly known as “Digital Natives”, “Net Generation”, “Generation Y” or “Millennials” grew up in a world immersed in digital technology and developed habits and skills in acquiring and processing information radically different from their predecessors. For this generation “technology is like the air” (Tapscott cited by Markova, 2013, p. 11). These digital natives are characterized by a high ability to multitask, they prefer to access information in an interactive and non-linear way and have a high media exposure time with a very significant weight in their everyday life (Rideout et al., 2010). For these students, the typical technological equipping of the classroom still contrasts with the panoply of digital technology they have access in their day-to-day. To reduce the technological distance from school to the rest of the world, the teaching strategies to ensure school success must necessarily adapt to these new habits and needs.

3.2.1 Cultural Generations

It is usual to classify age groups (Boomers, Gamers, Generation X, Generation Y, digital natives, etc.), according to the period in which the individuals of these groups were born and how society and the events that have occurred in the world during their childhood

\(^2\)http://moodle.com/
influenced them (Charles, 2010). The effects of technological change also influence this classification. References to these generations are usual in publications in the field of education, particularly about the use of ICT in education. This organization of historical knowledge, and its sociological analysis, made under the concept of generation, is common in countries like the United States. Table 3.1 shows this classification that organizes age groups according to relevant historical contexts in their countries although the phenomenon of globalization narrowed cultural or geographical differences. The table only shows the generations with most of their individuals still alive today. The current generation, the Z Generation Z, does not have yet a defined designation although names like Generation Alpha or Generation A, are in use. This is the first generation made only of individuals born in the 21st century. To designate this generation, other names are also proposed, like Generation T (T stands for tablet) or Generation App.

<table>
<thead>
<tr>
<th>Generation</th>
<th>Period of Birth</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baby Boomers</td>
<td>After the end of World War II to the middle of the 1960s</td>
<td>A generation influenced by technology and by television. The first generation with contact with video games</td>
</tr>
<tr>
<td>Generation X</td>
<td>Middle of the 1960 decade to 1979</td>
<td>A generation that grew up with computers moving into the home and with the rise of the Internet; more technologically minded than previous generations.</td>
</tr>
<tr>
<td>Generation Y</td>
<td>From 1980 to 1999</td>
<td>A generation that grew up immersed in technology, which affected most aspects of their daily lives; also known as Millennials.</td>
</tr>
<tr>
<td>Generation Z</td>
<td>From 1990 to 2009</td>
<td>A generation that lives since birth in a world immersed in technology</td>
</tr>
<tr>
<td>Generation Alpha</td>
<td>From 2010</td>
<td>The first generation entirely born in the 21st century;</td>
</tr>
</tbody>
</table>

The classification of individuals in cultural generations is controversial. It is not consensual its true meaning and importance. However, it has been widely used. Regarding education, there is a general tendency to divide people between those who were born and raised before the mass use of ICT, which includes most of the current educators, and those who were born or spent a significant part of their school life in a context dominated by digital technologies (which is the vast majority of current students). Video games are considered as a part of this technological reality, although the exposure to video games (since the 1960s) is prior to the exposure to ICT that had more expression from the last decade of the 20th century.
3.2.2 Digital Natives and Digital Immigrants

At the beginning of this century, Prensky (2001) claimed that “students have changed radically. Today’s students are no longer the people our educational system was designed to teach” (p. 1). According to Prensky, they are digital natives, those who were born after 1980. Digital natives grow up having as native “language” the language of digital information and communication technologies. In contrast, previous generations are digital immigrants. Most of the digital natives’ teachers are digital immigrants. They can learn the new digital language but it will never be their native language. Therefore, digital immigrants will always speak the digital language with an accent. From this metaphorical view of the digital divide between generations, Prensky (2001) advocates the need for a radical adaptation of teaching methods to this reality, where the students, the digital natives and their teachers, the digital immigrants, coexist. Concerning cultural generations, digital natives start with Generation Y. Several authors (Charles, 2010; Prensky, 2001; Tapscott and Williams, 2010) claim that digital technology has affected the way that digital natives think, “rewiring” their brains.

Apart those who stand for the existence of this new generation of learners, others argue for more empirical evidence to support the need to adapt education systems to digital natives. As an example, Bennett and Maton (2010) criticize the existence of a digital generation, distinct from previous ones, requiring new teaching methods. Advocating the need for further studies, these authors argue that the use of digital technologies and the skills revealed by individuals of the current generation of students is not uniform. While defending the need for further research in this field, to avoid what they call “moral panic”, they recognize that we live in a world heavily influenced by technology with a massive use by the younger generation.

The author of the digital natives/digital immigrants metaphor has recently evolved this notion of generations to a new metaphor named as “digital wisdom” (Prensky, 2012). His vision of education starts with the students: “what they need and how we can give it to them”. The goal of this new metaphor is to highlight the positive effects technology is having on humans. Technology can take people to a new development stage changing the way they relate with the world and with knowledge.

3.2.3 Residents and Visitors

Besides the usual classification based on the birth period of individuals, White and Le Cornu (2011) proposed another classification based on web use profile, related to the different forms of web access. In this classification, Internet users are classified as visitors and residents.
Chapter 3. *Information and Communication Technologies in Education* 30

A visitor is an online application user, which can use it with a high level of sophistication, but avoid creating a digital identity. This happens usually for privacy reasons. Users with this profile, enter online, do what they have to do on and get off avoiding leaving traces of their passage on the web. Visitors, irrespective of whether they have high levels of digital literacy or not, are not intensive users of Web 2.0 applications. They access these applications simply because they need to. For these users the web is just a collection of tools.

On the other hand, residents “live” online. The feeling of belonging to a virtual community is important for the profile of these type of users. Residents are, in general, users of SNS and content sharing applications.

More than a matter of age or skills in the use of technology, the division between these groups exist at the level of motivation (“It’s not about academic or technical skills, it’s about culture and motivation”). According to White and Le Cornu (2011), the distinction between natives and digital immigrants from Prensky (2001) is seen mainly at the level of a generation gap (“older people just don’t understand this stuff”). The gap between digital immigrant teachers and their digital natives students is generated in the first discomfort of not being able to follow the greatest ease of the seconds in which the use of technology is concerned.

In the classification proposed by White and Le Cornu (2011), there is no clear boundary between visitors and residents but rather a continuous. Each user can position himself at different points of this continuum. The user can be more a “resident” or more a “visitor”. This position may also vary for the same user, depending on the context: institutional or non-institutional. Thus, the same individual may be a resident when using online applications in an institutional perspective or professional context, and a visitor with respect to a non-institutional use in the context of his personal life. In White and Le Cornu’s perspective, the generational issue depends on privacy, with older individuals more reluctant to share personal information than younger individuals.

### 3.2.4 Net Generation

Tapscott and Williams (2010) called digital natives the “net generation”, those born between the early 80s of the 20th century and early 21st century. These people grew under the influence of technology and with great familiarity with the use of various digital media and digital technologies. The net generation is “the first generation in history to grow up digital” (p. 356). The individuals from this generations also grow up immersed in games, particularly, MMORPG’s (Massive Multiuser Online Role Playing
Games) and they are also familiar with Web 2.0 applications. Tapscott and Williams pointed for the need to teach and engage this generation with new models:

They’re simultaneously challenging the old style’s teacher’s lecture and calling for a new model that revolves around the student. They may even revolutionize the medium of education by demanding the use of new tools, new teaching styles, and a new model for student engagement. (p. 356)

Tapscott and Williams proposes a new model for the net generation, that he calls collaborative learning, to replace the model based on students absorbing contents and be able to recall them on exams.

### 3.2.5 Gamers

A gamer is someone who has grown up in a generation exposed to video games and technology (Upside Learning, 2009). These are the persons born from the 1960s and who lived with video games since childhood. According to Prensky (2007), they are the Gamers Generation that grew up in the last quarter of the previous century. At the beginning of the century, half of the workforce in the United States belonged to the Gamers Generation. The gamers generation includes people born in the last fifty years. Digital natives, in particular, “don’t remember a time when video games were not a staple in their lives” (Markova, 2013, p. 11).

Given the large time window for the Gamers Generation, Upside Learning (2009) proposed four sub-generations of gamers (from Gamers 1.0 to Gamers 4.0). It is possible to add a fifth generation, the Gamers 5.0. Table 3.2 shows these sub-generations with the corresponding birth years and gaming years, those years of greater involvement with video games. Examples of some commercial games and their main features are also presented for each generation.

### 3.3 E-learning 2.0

Web 2.0 applications brought a new way to view and use ICT. The new trends posed by Web 2.0 have effects on all areas where ICT are present. E-learning was no exception. This paradigm shift of the Web gave rise to the concept of e-learning 2.0, resulting primarily from social changes rather than technological.

Learning will be less and less confined to the physical space of the classroom but, instead or in parallel, is part of a virtual, ubiquitous space accessible by different means.
Table 3.2: Games Generations

<table>
<thead>
<tr>
<th>Game Generation</th>
<th>Birth years</th>
<th>Gaming years</th>
<th>Some defining games</th>
<th>Main game features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gamer 2.0</td>
<td>1971 - 1980</td>
<td>1981 - 1990</td>
<td>Pac-man, Space Invaders, Super Mario Bros, Tetris</td>
<td>Low level of interactivity, low player collaboration</td>
</tr>
<tr>
<td>Gamer 4.0</td>
<td>1991 - 2000</td>
<td>2001 - 2010</td>
<td>SimCity, The Sims, Halo, World of Warcraft, America’s Army</td>
<td>High level of interactivity, high player collaboration</td>
</tr>
<tr>
<td>Gamer 5.0</td>
<td>2000 - 2010</td>
<td>2010 - ...</td>
<td>Farmville, Pro Evolution Soccer, Angry Birds, League of Legends</td>
<td>Social and mobile games; multiplayer immersive environments</td>
</tr>
</tbody>
</table>

and equipments. The time in which learning occurs is no longer limited to the class timetable requiring simultaneously the physical presence of teachers and students. The learning occurs much more in network, resulting from interactions between students and teachers. The teacher is not anymore an entity that has the knowledge, controlling its transmission, but much more a counsellor, a mediator, a facilitator and a motivator of learning. Learning is much more collaborative, social, and often among peers. Technology-enhanced learning environments should address this reality. This could be accomplished through the integration of Web 2.0 functionalities and applications in various e-learning systems to allow the creation of online spaces that support better collaboration between students and teachers in a philosophy of pedagogical partnership and networked learning. The process of learning becomes more informal with a stronger social component. In this context, PLE and SLE assume particular importance.

### 3.3.1 Personal Learning Environments

According to Attwell and Costa (2009), PLE’s “are made-up of a collection of loosely coupled tools, including Web 2.0 technologies, used for working, learning, reflection and collaboration with others.” They can be seen as “spaces in which people interact and
communicate and whose ultimate result is learning and the development of collective
know-how. A PLE is an integrated and user-centered learning environment supporting
self-directed learning but also group-based learning. The concept is fluid but it is clear
that a PLE is not a technology but an approach or process (Johnson et al., 2012). PLEs
are a way to use ICT in education where students are put in charge of the learning
process. The approach has a great capacity for flexibility and customization and there-
fore a PLE is different from person to person. The PLE concept is based on knowledge
construction and sharing rather than on knowledge transfer (Buchem et al., 2013).

3.3.2 Social Learning Environments

A SLE is a particular way to look at the concept of PLE. Rather than an approach or
process, a SLE is a technological platform including or allowing the access to different
tools and applications, namely Web 2.0 applications. These tools help students to learn
and socialize. The PLE approach implies a high level of autonomy necessary to manage
all the available tools. However, such a level of autonomy may be difficult to achieve
for younger students, who are less proficient independent learners (Simões and Aguiar,
2011). They must be accompanied and guided in their use. In primary education,
security and privacy play an important role. A SLE can address all these features, if
implemented as an integrated platform closely connected to the real school. In such
platforms teachers and parents should also play an important role as active users. But,
as with traditional LMSs, SLEs need motivated and engaged users to be effective.

Hart, cited by Simões et al. (2013b), defines a SLE as “a place where individuals can
work and learn together collaboratively (both formally and informally) with others –
in course groups, study groups or in project and team spaces”. A SLE is a virtual
space where students, individually or in groups can gather to co-create content, share
knowledge and experiences, and learn. It includes a number of social elements that
provide an open environment for students to work, co-create, communicate and learn
collaboratively. As PLE’s should not just be user-centered but they should also focus on
the community and in the users’ social interactions (Attwell, 2012), a SLE can be seen
as an implementation of the PLE concept with a focus on the social interaction between
users and also covering issues like security and privacy.

3.4 Summary

The strong development of ICT, particularly the Internet, in the late 20th century al-
lowed the development of teaching strategies supported by these technologies giving rise
to the concept of e-learning. The limitations of e-learning from a pedagogical point of view are the fact that it cannot transmit emotion or engage the student as a teacher could. For this lack of feeling or emotional interaction, an e-learning system must compensate and try and stimulate learners with other means (Muntean, 2011). The quality of e-learning systems is, in many cases, negatively valued by users. Concepts such as PLE and SLE, where the student is at the center of the process, can make a contribution to this approach, redefining processes and teaching methodologies.

Children and teenagers today grow up immersed in many new digital devices, and as a result they think and process information in a radically different way from their predecessors. These digital natives need new ways of learning, more interactive, participative and individualized, that may help the creation, collaboration and sharing of knowledge with their peers, teachers, parents and school communities. Bennett and Maton (2010) argued against the existence of a digital generation but, regardless of the controversy surrounding this issue and the need to further investigation, the existence of this digital generation can be considered as a fact. An alternate approach, not based in the users’ age, is the visitors and residents approach.

Digital natives are also gamers, i.e., most of them have an experience related to the use of digital games, that could be just as casual gamers or as hardcore gamers, those who spend a considerable amount of time playing digital games. They play on their own or by

![Figure 3.1: ICT and Games Related Generations.](image-url)
interacting with other players over computer networks. “Digital natives” are therefore familiar with the aesthetics of games and with the game playing of digital games.

The gamers’ generation is older than digital natives. In fact, many people born in the 1960s and after are not gamers. Probably many had never played a videogame. But for digital natives, particularly those belonging the Z and Alpha generations, the Gamers 5.0 generation (Figure 3.1), there is a different reality: they are gamers. The youngest of them are still in school but the oldest are starting their active life.
Chapter 4

Games and Learning

Games are difficult to define, but they are well known for their ability to keep players motivated. Players usually have high levels of engagement with games. Since many centuries ago, games have been used to teach, and people played games to learn a skill or acquire new abilities. Video games are a kind of games that appeared in the middle of the twentieth century with the first digital computers. Video games are used in education almost since computers entered the classroom. This chapter starts with an analysis of what games are and discusses different types of video games and video games’ frameworks. The chapter also discusses why games are important for education and training and how they have been used in learning settings. But there are some difficulties in the games use in learning environments. Some of those difficulties and challenges concerning the use of games in schools are also discussed.

4.1 Games

The motivational power of games is well known and, many times, video games are seen as strongly addictive. As Prensky (2007) stresses, “computer and video games are potentially the most engaging pastime in the history of mankind” (p. 106). For Dicheva et al. (2015), “games have remarkable motivational power; they utilize a number of mechanisms to encourage people to engage with them, often without any reward, just for the joy of playing and possibility to win.” (p. 1). But it is hard to summarize in few words what makes games so attractive and engaging. McGonigal (2011) gives some hints about the power of games. In her view, games provide four important things:

- “Epic meaning”: the feeling of being involved in something great, people like to be challenged to perform important tasks;
• “Social fabric”: the participation in a social fabric, the possibility of generating social interactions since individuals tend to identify positively with others engaged in the same game;

• “Blissful productivity”: productivity leading to a state of joy and ecstasy, people feel better after perform hard and meaningful work;

• “Urgent optimism”: meaning an extreme self-motivation, the desire to act immediately to overcome obstacles and to believe that there are good chances to do it.

There are different kinds of games. Athletic games, board games or video games differ in the game space, the used artifacts and in the gameplay but they share the above features. Concerning gamification, video games are the most relevant kind of games but all games use strategies that can be moved to non-game contexts. Education is one of those contexts. As Farber (Schell cited by 2015, p. 122) puts, “the school system is setup as a game (...). It is a game, just a badly designed one”. Before exploring how games can be useful in learning settings, the following sections provide an overview of games, particularly, video games.

4.1.1 What is a Game?

A game is something that everyone can easily identify as such but that can hardly be formally defined. Ludwig Wittgenstein, an Austrian-British philosopher, stated that a game cannot be formally specified at all (Werbach, 2014). According to Wittgenstein, it is possible to easily say whether something is or is not a game. However, a precise definition is impossible because the word “game” refers to a variety of different activities (Chevtchenko, 2013). Several other authors attempted to provide guidelines to understand games and play. Huizinga, a Dutch historian, published the book “Homo Ludens” (1938) in which he discussed how play can promote socialization (Farber, 2015). He also pointed that humans, like some animals, play in order to praise important survival skills. Huizinga emphasized the importance of playing the game as a way to understand the game, which is something disconnected from reality. According to Bernard Suits, another philosopher cited in McGonigal (2011), “playing a game is a voluntary attempt to overcome unnecessary obstacles”. Roger Callois, a sociologist, in the second half of the 20th Century (cited by Prensky, 2007, p. 112), defined play as an unproductive activity that is not obligatory and uncertain in its outcomes. However, for some game designers like Koster (2005), games are not disconnected from reality, they are puzzles like everything else in real life. The only difference is that “stakes are lower with games”
(p. 35). For McGonigal (2011), games are productive activities in the sense that they produce immediate and obvious results (the feeling of “blissful productivity”).

Although Wittgenstein’s view about the impossibility to define what a game is, several researchers, game designers and game developers came out with some definitions. Sid Meier (cited by Martinho et al., 2014, p. 48), the designer of the popular computer game Civilization, claimed that “games are a series of meaningful choices”. A game is seen by Salen and Zimmerman (2003) as “a system in which players engage in an artificial conflict, defined by rules, that results in a variable, quantifiable outcome affected by player effort and ability” (p. 80). For others “a game is a system made by the participants in the playing activity, by the physical artefacts that are eventually used in the activity and by the rules that govern the activity” (Martinho et al., 2014, p. 46). Kapp (2012) proposed a definition to fit a learning context:

A game is a system in which players engage in an abstract challenge, defined by rules, interactivity, and feedback, that results in a quantifiable outcome often eliciting an emotional reaction. (p. 7)

Besides defining what a game is, several authors pointed the main features that a game must include. McGonigal (2011) stated that all games, electronic or not, must have:

- A goal, which is what gives meaning to the game, setting a target to be achieved;
- A set of rules that set out how the players must achieve the game’s goal;
- A feedback system, that tells the players how far they are to achieve the goal;
- A form of voluntary participation, with players participating in the game knowing and accepting the outset and the rules to achieve it.

In a learning context, Egenfeldt-Nielsen (2011) also pointed the characteristics that a good educational game should have:

- Integration, in the sense that the playful part must be integrated with the educational part;
- Motivation, meaning that the game should be so intrinsically motivating as possible;
- Purpose, meaning that the game must have a well-defined goal.
4.1.2 Video Games

A video game is a game played with the support of a video system (Martinho et al., 2014). It can be played in a game console, connected to a television set, in a desktop computer or in a mobile device like a smartphone or a tablet computer. Video games can be single or multiplayer and they can be played within computer networks. Egenfeldt-Nielsen (2011) defined electronic video games as virtual worlds with a conflict. Video games, as seen in the previous section, are not different from other games. Main differences are on the medium or on the location for gameplay to occur Schifter (2013). Hence, when defining and characterizing games, it is not relevant if they are computer-based or not. When games are computer-based, the digital space where they are played is what Johan Huizinga called the “magic circle” (Farber, 2015), a space that separates the game from the real world. Therefore, the terms “games” and “video games” are used interchangeably in this thesis.

According to Prensky (2007) playing a game on a computer enhances the play experience because the computer takes care of boring details, like some rules that tell what the player can and cannot do, allowing the player to enjoy more the play experience. Prensky points for many other reasons that explain why people like to play digital games on computers: digital games are more responsive and faster, they have varied graphic representations, they can offer different levels of challenge and they can be customized. He also points for the possibility that, in digital games, the player can play with the computer or with other people. With computer networks, everyone on line in the world can be a potential game partner.

4.1.3 Player Types

Video games are usually developed for a general public but video games’ developers have to deal with the different types of players that will play them. Players types classify players according to their motivations to play. Some players aim competition while others just want to socialize with other players. Some players seek to beat themselves and others just want to explore every detail in the game. Kim (2011) highlights the importance of the social component, that is, how the players engage with each other during the game. Questions like who the players are, who they play with, how they engage with each other and which parts of the game lead to greater player’s involvement are key issues concerning the implementation of gamification.

Game designers use models of players as a way to segment the game users. The best known model was proposed by Bartle (1996), a game researcher, for a kind of games
known as Multi-User Dungeon (MUD), a kind of text-only online games. In this model, players are considered in four different types: achievers, socialisers, killers and explorers. The Social Action Matrix from Kim (2014a) adapted Bartle’s player types to the Web 2.0 (Figure 4.1).

![Figure 4.1: Player Types: Social Action Matrix (Based on Kim (2014a)).](image)

The Social Action Matrix has four key patterns: explore, create, compete, and collaborate. In each quadrant, social actions, or verbs, illustrate the meaning of the four key patterns. Explorers are motivated by gaining knowledge, finding the rules in the game space and test boundaries. Creators look for opportunities for self-expression. Competitors are motivated by testing their skills and compare to others. Collaborators are motivated by team work in order to reach a greater goal.

Both of the above proposals emphasize competition but also collaboration and the social interactions that occur when playing with others.

### 4.1.4 Game Frameworks

Game frameworks try to offer developers an overview of how a game must be developed and how players will interact with the game. One of the most cited games’ framework is the MDA (Mechanics, Dynamics and Aesthetics), proposed by Hunicke et al. (2004). These authors identify three key components in games: a set of rules, a system and fun (rules, system and “fun”). The three components are related to the same number of design elements:
• Mechanics: components of games in terms of data representation and algorithms. Rules and concepts that formally specify the game as a system.

• Dynamics: the mechanics dynamic behavior as a result of interactions with the player.

• Aesthetics: the desirable emotional player’s responses as a result of the interaction with the game. Desirable emotional responses as a result of dynamics.

These three design elements are part of MDA. This framework seeks to be a formal approach to understanding games. The three elements represent different perspectives on what a game is. MDA distinguishes the role of the designer, the person that creates the game, and the player, the person that consumes the game. Aesthetics is the element closest to the player and mechanics is the element closest to the designer (Figure 4.2).

Figure 4.2: The MDA Framework (adapted from Hunicke et al. (2004)).

The 4keys2fun\(^1\) can be seen as a framework on how to consider fun in game design. This approach, proposed by Lazzaro (2004), is the result of an independent research study on why people play games. In this study over thirty emotions coming from gameplay were identified. Lazzaro also found four different types of fun that create games' four most important emotions. These types of fun, as described in Murphy et al. (2014), are:

• Hard Fun: “associated with attaining and exercising mastery through goal completion. It involves overcoming obstacles by applying skill and strategy”.

• Easy Fun: “associated with play in real life. It often involves elements of exploration, creativity, or fantasy where goals are often personal and not imposed by predetermined objectives”.

\(^1\)http://www.nicolelazzaro.com/the4-keys-to-fun/
Chapter 4. Games and Learning

- Serious Fun: “describes the enjoyment that players get from the experience itself. It is sometimes referred to as altered states. Serious fun is focused on the emotions that frequently result from repetition, rhythm, or collection such as excitement, zen-like focus, or relaxation”.

- People Fun (or social fun): “based on the interactions between people such as communication, cooperation, and competition. It results in feelings of friendship, amusement, bonding, and admiration”.

According to Lazzaro, these are the four main reasons why people play games. Each of these key unlocks a different set of play experiences and a good game should offer at least three of these four keys to fun.

4.1.5 Social Games

Social games are a kind of video games that become popular among SNS users. Social games are a subcategory of casual games, defined by Landers and Callan (2011) as any game that does not fit under the label of “hardcore game”. Hardcore games are the most sophisticated video games that involve significant production efforts and means and aim an audience made up of teenagers and young adult males. Hardcore games usually involve competition and can be played online. On the other hand, casual games cover a more diverse audience, the players that are not the traditional audience for computer and video games. Casual games are usually less sophisticated, both graphically and in terms of complexity (Wojcik, 2013). Regarding online social gaming, Richetti (2012), considers as social games, not only casual games but also some MMORPGs, many of them also available for SNS users. According to (Radoff, 2011), a social game is just a game that people play with each other and for Werbach and Hunter (2012) they are online games delivered through SNS, where social interactions play a central role. Social games have unique features that distinguish them from other video games, closely connected with SNS features as pointed out by Järvinen (2009), who studied the design of several of these games.

The number of social gamers has grown significantly in recent years, and most of them use mobile devices to play. Social games are played as a way to interact with friends and are part of the digital natives’ culture but also reach broader audiences. Social games users play them as a way to alleviate boredom, to connect with other players or by the competition they provide (Mahajan, 2010). They are still characterized by requiring a lesser player commitment since players can leave and reenter the game whenever they want without any penalty or consequence (Richetti, 2012).
In social games, players have to perform tasks with clear objectives, and they may receive badges or other trophies whenever they succeed. These achievements can be used to gain access to new, more demanding challenges. Trophies taken by a player can be shared on the player’s SNS, acting both as a social recognition and also to encourage other users to play the game. Other SNS users, the player’s friends, can encourage the player that will feel more motivated to face new challenges. In some games, players can offer virtual goods to other players. Particularly in MMORPGs, players can also join in groups and form communities (“guilds” or “clans”) so that together they can overcome challenges too difficult for a single player.

The spread of social games changed the usual profile of video games players. The players average age increased with more female players. More people became familiar with the aesthetics and language of videogames. Social games are tightly integrated with SNS and they can create social play experiences related to the players’ real-world social ties.

### 4.1.6 Pervasive Games

Pervasive gaming, according to De Freitas (2006), include the kind of games that uses mobile devices (e.g. smartphones or tablet computers) over a computer network, like the Internet, enabling users to play in different locations and in different moments in time. These features mean that pervasive games are available always and everywhere. With pervasive games there is also an integration between the physical and the virtual worlds.

Deterding et al. (2011) point for the social interaction component of persuasive games, along with the expansion from a spacial and temporal bounded context. These authors give some examples of pervasive games like location-based games that take place in the physical public space, augmented reality games that use digital elements to enhance physical world scenarios, persistent games that continually run to be entered and exited during the course of the day, or alternate reality games, that are usually large-scale multiplayer games that mix electronic and virtual elements with physical world experiences (De Freitas, 2006).

With pervasive games, video games are located along a real-virtual continuum, with games taking place in virtual environments and games that interact with the real world using augmented reality technologies. Technology driven gaming experiences can take place in physical environments, virtual environments or both and allow players to interact without time or physical barriers. Pervasive games are ubiquitous and they combine different forms of interaction and access devices. The transition between the real and
the virtual worlds is fluid. The services offered are presented to the players depending on their context in the real world or in the virtual world.

4.1.7 “Gaming Can Make a Better World”

The idea that “gaming can make a better world” was proposed by McGonigal (2010) in a TED talk. In this talk, McGonigal says that, in game worlds, people feel that they become better versions of themselves, motivated to stick with a problem as long as it takes, to try again and again after failure, until they succeed. With games, players often feel that they can achieve anything. Taking those feelings from games and applying them in real-world settings is the reason behind this author’s claim that “gaming can make a better world”. McGonigal points for other reasons. In online games, players work together to achieve common goals and they get immediate feedback for their actions.

In her presentation, McGonigal cites empirical research that found a “average young person in a country with a strong gamer culture will have spent 10,000 hours playing online games by the age of 21”. This number of hours is the amount of time that people in the United States spend in school from fifth grade to high school graduation. So, when young gamers reach adult life, they master games. McGonigal questions how the world societies can take an advantage of this facts. Skills acquired by gamers empowers them. Empowered people have the feeling of being able to change the world. Gamers feel that they can change their virtual worlds. The questions that McGonigal rises is why not use those skills to change the real world? She also claims that people are now using games to get away from their real environments, where life is not so satisfying, and taking that satisfaction from games. McGonigal concludes that gamers are a human resource that can be used to solve real world problems and that games can be a platform for change.

Although visionary and not explicitly mentioning the word “gamification”, McGonigal’s presentation was an inspiration for many gamification practicioners and researchers. Most of the key ideas in the presentation are in the foundations of gamification, that will be further analysed in Chapter 5.

4.2 Game-Based Learning

Games have always attracted the attention of educators and have been used in schools for a long time (Farber, 2015; Schifter, 2013). In the last decades, the popularity of video
games and the introduction of information and communication technologies in the classroom gave rise to a trend known as Game-Based Learning (GBL) to deal with games that have defined learning outcomes. GBL and, more recently, Digital Game-Based Learning (DGBL), attracted the attention of educators and corporate trainers. Video games are highly engaging and academics and practitioners like Prensky (2007), Gee (2007) or Nolan and McBride (2013) advocate their potential to increase engagement in learning contexts (Gee identified thirty six different ways to learn with videogames). Van Eck (2006), citing Piaget’s research, stated that learning results from assimilation and accommodation processes. Assimilation is to put new information into existing categories, based on previous experiences. The accommodation comes when learners need to modify the existing model of world’s knowledge when there is new information that does not fit into existing categories. The contradiction that exists in both cases results in a cognitive imbalance that is the key to intellectual maturity. Games incorporate cognitive imbalance and its resolution and, therefore, they are appropriate learning tools.

Prensky (2007) claims the use of electronic games in education, stating its natural use for future generations. To Prensky, there are three reasons for his claim:

- Electronic games meet the needs and learning styles of future generations (digital natives);
- Learning through electronic games is motivating considering its playful nature;
- This form of learning is versatile, applicable to different learning content and allowing the development of different skills.

So far, digital game-based learning have been applied by educators with three main approaches (Corcoran, 2010; Van Eck, 2006):

- Using commercial off-the-shelf (COTS) videogames, when those games have contents that can be used for educational purposes.
- Using Serious Games, a type of video games where learning is the primary goal (see Section 4.2.1).
- Students building their own games, allowing the development of problem-solving abilities, programming skills and game design skills.

However, these approaches to the use of games in education have some drawbacks and pose complex challenges. COTS video games have several limitations since the contents
are limited and may not be complete and accurate. Learning occurs only as a side effect. Not all COTS video games have the same potential. Many of them have dubious educational value. However, in general, all COTS video games allow developing digital literacy skills, problem-solving abilities and increase manual dexterity, visual acuity and hand-eye coordination.

Producing serious games, with the quality of commercial video games requires large budgets. This is a major drawback because the scarcity of quality educational games is a strong barrier to a wider adoption in schools. An educational game “typically targets only a single set of learning objectives as chosen by the game designer. In addition, their effective classroom adoption requires certain technical infrastructure and appropriate pedagogical integration” (Dicheva et al., 2015, p. 1).

When students build their own games, teachers also need to have some expertise in game design and game development, which is difficult for most subjects. Regarding this third approach, one of the most popular platforms is Scratch\(^3\), from the Massachusetts Institute of Technology’s Media Lab. Another example is Microsoft’s Kodu\(^4\), a visual programming language to build games for the Xbox platform and designed to be used by children. Both of these programming platforms also allow users to be part of online communities supported by social platforms, respectively, ScratchR and Planet Kodu.

Strictly concerning games with educational and training goals, besides serious games, also simulations and virtual worlds are used in learning contexts, all under what became known as GBL. They are used especially outside of formal education, mainly in vocational training and in specific sectors such as military training or health. These three perspectives for GBL are detailed in the following sections.

4.2.1 Serious Games

Serious Games is a term usually used to designate games with educational purposes. The term was coined by Clark Abt who published the book “Serious Games” in 1970 (Farber, 2015). Abt, cited by Ulicsak and Wright (2010, p. 24), defined serious games as games that “have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement. This does not mean that serious games are not, or should not be, entertaining”. Other definitions can be found as the one proposed by Zyda (2005): “a mental contest, played with a computer in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives” (p. 26).

\(^3\)https://scratch.mit.edu/
\(^4\)http://www.kodugamelab.com/
Zyda also states “serious games use pedagogy to infuse instruction into the game play experience” (p. 26).

The game America’s Army\(^5\), initially launched in 2002 as a means to increase the number of American army recruits, was one of the first games to be classified in the category of Serious Games. The game was then adopted by the United States Army to train its military and revealed the potential use of electronic games for purposes other than simple entertainment (Zyda, 2005).

Other examples of use of serious games include the Games for Change project\(^6\) that promotes games to develop social responsibility (fighting hunger, promoting public health and human rights, etc.). Mingoville\(^7\) is a serious English learning game based on the idea that children learn and are better motivated by activities that involve problem-solving and games. DragonBox Algebra\(^8\) is a serious game for tablet computers to teach Algebra. Food Force\(^9\) is a video game, from United Nations’ World Food Program, to teach children deal with humanitarian crisis and disaster response. Another example is the Global Conflicts series\(^10\), to help students to learn about different conflicts in the world, covering themes like democracy, human rights, globalization, terrorism, climate and poverty. Several other examples can be found at the Serious Games Association, an international organization serving the serious games industry, that keeps a directory of serious games\(^11\).

4.2.2 Simulations

According to Kapp et al. (2014), a simulation\(^12\) provides a cost-effective scenario for training tasks that would be costly and time intensive to set up in a real scenario. Simulations must be realistic, they should allow to practice behaviors and experience the impact of decisions. Still according to Kapp et al., simulations and games share common features. They both have story line, they can be competitive and they can keep some kind of score. But while games may not reflect reality, simulations must be realistic representations of the real world. Some of the main scenarios for simulations can be found in military and medical training. Simulations comprise a set of rules,

\(^5\)http://www.americasarmy.com/
\(^6\)http://gamesforchange.org
\(^7\)http://www.mingoville.com/
\(^8\)http://www.dragonboxapp.com/
\(^10\)http://www.globalconflicts.eu
\(^11\)http://www.seriousgamesdirectory.com/
\(^12\)Some examples of simulations can be found at http://www.clarkaldrichdesigns.com/p/examples-of-simulations.html
challenges, and strategies designed to develop specific competencies that can be directly transferred into the real world (Aldrich, 2009).

4.2.3 Virtual Worlds

Virtual worlds are mostly multiplayer, typically involving immersive three-dimensional social environments, without the existence of a specific objective (Aldrich, 2009). Kapp (2012) defines virtual worlds as online spaces in which users, represented by avatars, can interact with one another. Unlike games, simulations do not aim a particular goal. Examples of virtual worlds used in educational contexts are Second Life\textsuperscript{13} and Minecraft\textsuperscript{14}, a multiplayer sandbox video game. In these environments, there is no story line or narrative progression but instead, the user has to create the story. A virtual world like Minecraft can be used by a single individual or by a group of individuals and it can be played on a desktop computer or on tablet computer Schifter (2013). The main purpose of these environments is to allow users to explore the “world” they present.

4.3 Summary

Video games are no longer a single user software application running on a personal computer or on a games console. Computer networks made video games a virtual space where players from any place in the world can gather to play with each other or against each other. The evolution in the graphical capabilities of computer hardware contributed decisively to the development of the video games industry. The Web 2.0 brought a social component to games and the number of casual gamers increased in the last decade. Mobile technology allow gamers to play everywhere.

Since games are a teaching and training tool for a long time, recent developments in the video game industry brought new possibilities to use video games in learning settings, where digital technology increased its presence. DGBL is now a reality but there are still many difficulties and barriers in using video games for educational purposes, from both teachers and students: “bringing effective games to students has many barriers. Teachers may see play as frivolous, while students may be biased against learning games in school” (Farber, 2015, p. 24). Also, games require “a large amount of design and development efforts” (Dicheva et al., 2015, p. 1) and, therefore, “creating a highly engaging, full-blown instructional game however is difficult, time consuming, and costly” (Kapp, 2012).

\textsuperscript{13}http://secondlife.com
\textsuperscript{14}https://minecraftedu.com/
Chapter 5

Gamification Fundamentals

This chapter offers an overview of the concept of gamification. Several definitions of the concept, representing the views of different authors are presented. The chapter describes the origins of the concept and how it evolved since it was mentioned for the first time. As the concept spread, different categories and approaches arose and they are also analysed. The backgrounds of gamification are also mentioned and some of the most representative known gamification’s applications are shown, with special focus on the education field. The chapter includes a set of gamification frameworks and commercial platforms and concludes with some critiques facing the concept of gamification.

5.1 The Concept of Gamification

Today, in most developed countries, the society is embedded in a technological environment characterized by a generalized access to large amounts of information. People are not just passive consumers of this information but can also contribute with new content and by combining existing content. The social dimension is also present in this environment, brought by the Web 2.0, particularly, by social networks sites. The gaming industry also took advantage of these technological trends, leading to a vast community of gamers of all ages. A new trend also arises from this environment: the tendency to apply the components and techniques of video games in activities and contexts not related with video games and even not related with technology. This trend has been been popularized under the name of “gamification”. Gamification has been implemented in a wide range of fields, like loyalty programs, marketing campaigns, language learning, social networks, corporate intranets, healthcare or education.
5.1.1 Origin and Evolution

The concept behind what became known as *gamification* was already known almost one hundred years ago. *Nelson* (2012) argues that the origins of gamification are in the early to mid 20th century in Soviet Union, like “a way to motivate workers without relying on capitalist-style monetary incentives” (p. 23). Workers and factories could compete with each other to increase production, using points and other game-like elements. Later, in American management (*Markova*, 2013), on the transition from the 20th to the 21st century, the strategy of turning the workplace into a more playful setting reappeared. In 1984, *Coonradt* (2007) published the first edition of his book *The Game of Work*. *Coonradt*, known as the “grandfather of gamification”¹, applied game principles in business contexts, dealing with employee motivation. His principles to motivate people include frequent feedback, clear goals and personal choice, features that can be found in games. These American and Soviet approaches, as precursors of gamification, gave rise to a sub-genre of the concept, the “gamification of work”, the merger of play and labor, also known as *playbor* (*Anderson and Rainie*, 2012). Even before *Coonradt*’s work, loyalty programs, like frequent flyer programs in airline companies (*Kumar and Herger*, 2013), where travelers gain miles (i.e. points) that can be exchanged by some benefit, and other marketing campaigns already incorporate game features.

In other contexts, similarities with game elements can be found in the use of icons or symbols to express achievements, like insignias on military uniforms or insignias used on youth organizations like the Scouts (*Silvers*, 2011; *Werbach and Hunter*, 2012). These icons and symbols have their digital counterpart in video games’ badges (*Rosewell*, 2012). As the Scout can collect badges and display them on their uniform, digital badges can be used to display individual skills, abilities and accomplishments, since a software system provides the adequate infrastructure.

In the ICT context, *Deterding et al.* (2011) noted that, in the 1980s, in Human-Computer Interaction (HCI), the design of user interfaces already benefited from the knowledge of different design practices, namely game design. *Playfulness*, as a desirable user experience or mode of interaction, gained the attention of multiple HCI researchers. As *Deterding et al.* refer, game elements were long used in HCI, as game controllers used as input devices or graphic engines and authoring tools of video games used in non-ludic contexts.

GBL and the serious games movement (see Section 4.2.1) contribute to the spread of the concept, revealing that games could be useful in non-ludic contexts instead of just being used for fun and amusement. Therefore, gamification involves many different areas like

---

HCI, game studies, and serious games, but also pervasive games, alternate reality games, productivity games (Schlagenhauf and Ambert, 2014) and concepts like playful design (Deterding et al.).

Regarding the concept’s name, several authors claim that the term gamification, a neologism, was created in 2002 (Marczewski, 2012; Penenberg, 2013), or 2003 (Werbach and Hunter, 2012), or 2004 (Rughinis, 2013a) by Nick Pelling, a British programmer and video game designer. In fact, according to this alleged author, the word was created in 2002 (Pelling, 2011) and became public in 2003 in Pelling’s company website\(^2\). By then, he intended to apply his gamification ideas to electronic devices. Others claim the term’s authorship for themselves at even earlier dates: “a trend I call gameification, which I first identified in the early eighties” (Burrus and Mann, 2012). Other sources indicate that the term was invented by Tim Chang\(^3\) from Norwest Venture Partners at an undefined date. The origin of the term cannot be dated back unambiguously (Schlagenhauf and Ambert, 2014).

In digital media and according to Huotari and Hamari (2012), the term, written as gameification, was mentioned for the first time in 2008 in a blog post (Terrill, 2008). Werbach and Hunter (2012) note also that it was only in 2010 that the term was widely adopted. In fact, the term only started to be searched in Google in August, 2010 (Duggan and Shoup, 2013; Zichermann and Linder, 2013).

Before the term gamification came into widespread use on digital media, the underlying concept was also known as funware, a term proposed by Zichermann (2010)\(^4\). Similar terms were associated with the concept like fun at work, serious games, human-focused design (Chou, 2013) or games with a purpose (Rughinis, 2013a), although these last two terms are, in fact, related with different concepts. Landers and Callan (2011) also used the term gameification, applying it in learning contexts. Besides all these alternative terms, the word gamification prevailed even not being consensual.

Some video presentations at the TED Conferences\(^5\) became very popular in digital media highlighting the importance of game thinking, with perspectives from game designers like Chatfield (2010), McGonigal (2010) and Schell (2010) or perspectives from digital marketing professionals (Zichermann, 2011).

In 2011, the word gamification was part of the Oxford University Press short list for the word of the year\(^6\). In the same year, Jane McGonigal published Reality is Broken: Why

---

\(^2\)http://www.nanodome.com/conundra.co.uk/
\(^3\)e.g. http://tinyurl.com/njh85kg
\(^4\)http://venturebeat.com/2008/05/09/funwares-threat-to-the-traditional-video-game-industry/
\(^5\)http://www.ted.com/pages/about
Games Make Us Better and How They Can Change the World (McGonigal, 2011), a book about how features from video games could be used in different contexts making a contributions to a better citizenship and to a better world. Although McGonigal, a game designer, never mentioned the word gamification, the concept was present and inspired several other gamification’s developers and researchers. Many software applications, digital services, campaigns, products and communication strategies released in 2011 and after were inspired by this gamification movement.

In the business world, Gartner, an information technology research and advisory company, made a contribution for the popularity of the concept by making predictions stating that in 2014 most companies will have at least one gamified application (Duggan and Shoup, 2013) or that, in 2015, 70% of the world’s largest enterprises will be using gamification (Penenberg, 2013; Zichermann and Linder, 2013). Accurate or not, these predictions brought new highlights for gamification that become a new trend in business.

Since 2011, Gartner added gamification to its “hype cycle for emergent technologies” (Figure 5.1), pointing, in 2011, for a period of 5 to 10 years for mainstream adoption. Gartner uses hype cycles to track technology adoption: after the “peak of inflated expectations” period, technologies will fall into the “trough of disillusionment”. Then, they will start evolving to the “slope of enlightenment” and some of them will reach the “plateau of productivity”. In 2013, gamification was at the “peak of inflated expectations”. Gamification became a buzzword in the business world and a popular term in digital media. By 2014, gamification was placed in the “trough of disillusionment” (See Figure 5.2) with a prediction to reach the “plateau of productivity” in 2 to 5 years.
Chapter 5. Gamification Fundamentals

With an increasing number of scholars and professionals becoming interested in the concept, along with the general public, the online learning platform Coursera\(^7\) launched in August 2012, a MOOC on gamification, lectured by Kevin Werbach, an Associate Professor from the University of Pennsylvania. The course had more than 80,000 registered students with further editions in 2013 (about 66,000 students), 2014 (with 78,000 registrations) and 2015 (around 40,000 registrations). After the first edition of the course, Werbach co-authored the book *For the Win: How Game Thinking Can Revolutionize Your Business* (Werbach and Hunter, 2012).

Since 2011 a large number of web log posts were released covering gamification related themes. These first references to gamification were very informal and debated the advantages or drawbacks of the concept and look for examples within web applications. Books on gamification were also published (e.g. Kumar and Herger, 2013; Paharia, 2013; Zichermann and Cunningham, 2011). Most of them approach the concept with a business or enterprise view and others cover specific areas of application, like education and training (Farber, 2015; Kapp, 2012; Kapp et al., 2014). These gamification guidebooks, aiming general audiences, cannot be considered as strictly scientific publications on the matter.

\(^7\)https://www.coursera.org/
The academic community began to look at gamification with a more scientific approach, starting by defining what gamification was (Deterding et al., 2011; Huotari and Hamari, 2011). Researchers gathered in communities and the first gamification workshops and events were organized. The number of scientific publications on gamification grew and by 2013 there were more than two hundred academic papers published (Hamari et al., 2014). Some of these scientific publications with empirical studies concerning education can be found in Chapter 7.

Still, the concept is seen by many as misleading and difficult to define (Anderson and Rainie, 2012; Raczkowski, 2013) and as Robertson (2010) claims “is the wrong word for the right idea”. Although game design is central to the concept of gamification, some game designers do not agree neither with the word nor with the concept (e.g. Bogost, 2011a). As long as the word became popular, criticism of gamification also made a presence in digital media. Some game designers point that gamification is just a meaningless buzzword. Depreciative terms like exploitationware (Bogost, 2011b) or pointsification as proposed by Robertson, show that both the word and the concept are not consensual.

Herger (2013) refers some alternative terms like engagification, persuasive design, behavioral design or motivational design. Gameful design (McGonigal, 2011) or persuasive games (Bogost, 2011b) are some other alternative terms.

As the concept evolved and the first applications became known, different categories and classifications were proposed, based on the different approaches and features present on those applications. These different types are described in Section 5.2. The next section lists some of the proposed gamification definitions.

### 5.1.2 Definitions

The definition used in this thesis is presented and explained in Chapter 8, but there are several other definitions. Simões (2012) listed diverse definitions (23) found in web logs, technical reports and academic papers. Many of them are redundant or very similar to each other. This list, along with the proposals presented in this section, shows that there is no consensus for a single and widely accepted definition for gamification (Werbach and Hunter, 2012).

Hence, some of those definitions, found in books, web logs and video presentations, are the following:

---

8http://gamification-research.org/
• “The notion that gaming mechanics can be applied to routine activities” (Johnson et al., 2014a);
• “The use of game mechanics and rewards in non-game setting to increase user engagement and drive desired user behaviors” (Duggan and Shoup, 2013);
• “Implementing design concepts from games, loyalty programs, and behavior economics to drive user engagement” (Zichermann and Linder, 2013);
• “The use of game elements and game-design techniques in non-game contexts” (Werbach and Hunter, 2012);
• “The application of game metaphors to real life tasks to influence behaviour, improve motivation and enhance engagement” (Marczewski, 2012);
• “Using game techniques to make activities more engaging and fun” (Kim, 2011);
• “The use of game attributes to drive game-like player behavior in a non-game context” (Wu, 2011);
• “Taking game mechanics and applying to other web properties to increase engagement” (Terrill, 2008).

Other definitions found in academic papers and thesis are:

• “A design strategy where game elements are used in non-game applications to promote behaviour change and enhance the hedonistic qualities of the user experience” (Fitz-Walter, 2015);
• “Using psychological tricks from games in other areas of life” (Stokes, 2014);
• “The use of game mechanics, dynamics, and frameworks to promote desired behaviors” (Lee and Hammer, 2011);
• “The use of game design elements in non-game contexts” (Deterding et al., 2011);
• “A form of service packaging where a core service is enhanced by a rules-based service system that provides feedback and interaction mechanisms to the user with an aim to facilitate and support the users’ overall value creation” (Huotari and Hamari, 2011).

The first known definition in an academic paper is the one from Huotari and Hamari (2011). In spite of all these different proposals, the definition that is more often cited is the one from Deterding et al. (2011). This definition is now widely used as the academic
definition for the concept of gamification (e.g. Fitz-Walter et al., 2013; Mekler et al., 2013; Nicholson, 2012b). This definition is used by 45% of applied gamification research papers (Seaborn and Fels, 2015).

In the enterprise and business context, Burke (2014) defined the concept as “the use of game mechanics and experience design to digitally engage and motivate people to achieve their goal”. The major issue concerning this definition is about “digitally engage”. In Burke’s view, gamification can only be applied in a digital context because “players interact with computers, smartphones, wearable monitors or other digital devices, rather than engaging with a person”.

Werbach (2014) proposed a definition focused on the notion of gamification as a process: “gamification is the process of making activities more game-like” (p. 1). In Werbach’s view, his definition “creates a better fit between academic and practitioner perspective”. Most definitions rely on the use of game elements, in what he calls the elemental definitions, using game elements in non-game contexts is not the same as transforming that context into something more game-like. To achieve that, a process is needed. The process can transform the activities to be more or less game-like. Therefore, according to Werbach, the frontier between gamified and non-gamified settings is wider. He points that in education, the fact that a point system is used (the grades), it is not possible to say that school activities (e.g. examinations) are gamified.

The importance of data analysis in the process of gamifying a non-game context is stressed in Paharia (2014) definition: “gamification is about motivating people through data. Data is used to motivate users’ better performance in online experiences.

Finally, Marczewski (2014) proposed an “average definition” for gamification: “creating more game-like experiences in non game contexts”. He points that this definition “does not include anything about why or how, just what it is”. This proposal results from an average of a list of other definitions looking at the most common concepts used in those definitions.

5.2 Gamification Categories

5.2.1 BLAP Gamification

Most current gamified systems rely on providing some external rewards regarding players activities. These systems use the most common game elements like points, badges, levels, leaderboards or achievements. This is what some call BLAP gamification (Nicholson, 2012b), BLAP standing for Badges, Levels, Leaderboards, Achievements, and Points.
Some of these elements are also known as the PBL triad (Werbach and Hunter, 2012), PBL standing for Points, Badges, and Leaderboards. According to Nicholson BLAP (or PBL) gamification is focused on adding goals and structure to a non-game context:

\[
\text{BLAP Gamification} = \text{Goals} + \text{Structure}
\]

BLAP gamification aims extrinsic motivation. According to Nicholson, reward-based gamification is only suitable in contexts seeking for immediate and short-term behavior change. A desired behavior can be motivated by rewards but as soon as the rewards end the behavior also ends. This effect is also pointed by Zichermann and Cunningham (2011). The reward-based approach to gamification can be suitable if there is no way to drive intrinsic motivation in the target population of the gamified process. An even serious danger of a reward-based approach, pointed by Nicholson is that extrinsic rewards can replace intrinsic motivation. Outside incentives can be counterproductive. If someone performs an activity with some intrinsic motivation, adding rewards to encourage a behavior related to that activity may cause that the person will be less likely to engage with the behavior.

5.2.2 Meaningful Gamification

The notion of Meaningful Gamification was also proposed by Nicholson (2012b) and is defined as “the use of gameful and playful layers to help a user find personal connections that motivate engagement with a specific context for long-term change” (p. 5).

Furthermore, the same author also states that “meaningful gamification is the integration of user-centered game design elements into non-game contexts” (Nicholson, 2012b), putting the user at the center of the process. This perspective of gamification tries to go deeper than the reward-based gamification known as BLAP gamification (see the previous section).

The meaningful gamification approach relies on the belief that people engage in some activities because they are intrinsically motivated to perform those activities. To accomplish this, people must have a feeling of autonomy, competence and relatedness towards the task, which are the pillars of the Self-Determination Theory (see Section 6.3). In summary, meaningful gamification is the use of game elements, in non-game contexts to help build intrinsic motivation and meaning (Nicholson, 2014).

Play is a central element for meaningful gamification. How are games and play related? A game is “a form of play with goals and structure” (Maroney cited by Nicholson,
Therefore and concerning BLAP gamification,

\[ \text{BLAP Gamification} = \text{Goals} + \text{Structure} = \text{Game} - \text{Play} \]

Rather than relying on external rewards like BLAP gamification (where play is absent), meaningful gamification focus on play as a way to find meaning and engage participants in a gamified activity. As play is, by definition, optional (Nicholson, 2014) it raises difficulties to apply a meaningful gamification approach in educational contexts, since the students’ participation in a gamified learning activity should not be optional. One way to surpass this difficulties is to support the learning activity with a technological platform (a computer-mediated environment) that allows some form of play or may lead users to a feeling of play.

5.2.3 Implicit and Explicit Gamification

Chou (2013) differentiates two strategies to apply gamification: the concepts of implicit gamification and explicit gamification. Chou considers that serious games and other kind of non-ludic purpose games, like advergames\(^9\), should be considered as gamification since they use game design to achieve a non-game productive result. He also highlights the indistinct line between what should be considered as a game and what is not a game. Hence, explicit gamification consists of strategies that utilize game-like applications. Users acknowledge they are playing a game. Serious games and advergames lie in this category. Implicit gamification, on the other hand, are design techniques that do not show signs of a game, but are filled with game design elements that are not perceived as such by the users. Chou emphasizes that neither one of these categories is better than the other. The choice depends on the purpose of the non-game context as well as on the users since some people are more prone to participate in games than others.

5.2.4 Structural and Content Gamification

According to Kapp et al. (2014), there are two types of gamification: structural gamification and content gamification. Kapp et al. considers these two types applied in

\(^9\)Advergames or advertising using games; games that contain an advertisement for a product, service, or company, http://www.businessdictionary.com/definition/advergame.html
learning and instruction contexts. Structural gamification is the application of game elements without changing the learning contents, which means that the content does not become game-like. Elements like points, badges, leaderboards, social sharing or reward structures are considered to belong to structural gamification.

With content gamification the content is altered to become more game-like. This can be accomplished by the use of not only game elements, like in structural gamification, but also by applying game mechanics and game thinking. Elements like story, challenge, curiosity and character are considered as content gamification elements. Also elements like interactivity, feedback and freedom to fail are considered as belonging to content gamification. In Kapp et al.’s proposal it is not clear the distinction between “game elements” and “game mechanics” (a common situation as it will be seen in Section 8.4.1). “Game thinking” is about adding to an activity, elements of competition, cooperation, exploration and storytelling. Kapp et al. points that elements of each of the two types can be used interchangeably and that the two types often overlap.

5.2.5 Extrinsic and Intrinsic Gamification

Marczewski (2013c) proposes two gamification categories: extrinsic gamification and intrinsic gamification. Extrinsic gamification or “Short Term Thin Layer” gamification is associated with the use of game elements like points and badges that lead to short term engagement.

Intrinsic gamification or “Long Term Deep Level” gamification aims to keep people involved because they want to be involved. Marczewski relates intrinsic gamification to his definition of motivational drivers for intrinsic motivation, coined as RAMP, standing of Relatedness, Autonomy, Mastery, Purpose (see Section 6.7.2 for details). Using an intrinsic gamification approach it is possible to engage people to a deeper level than by just the use of PBL/BLAP elements.

Marczewski classifies serious games as “Short Term Deep Level” because, although they are deeply engaging, they are designed for specific purposes that last for the length of the game. When serious games goals are reached, the problem is solved and the game finishes. Engagement only lasts for a short period.

5.2.6 Internal, External and Behavior Change Categories

Werbach and Hunter (2012) identify three main non-game contexts that result in three
different gamification categories: internal gamification, external gamification and behavior change gamification. The first category, internal gamification (or enterprise gamification), deals with the increase of companies productivity. The players are the company’s employees and the approach can be used to increase competition among a sales team.

External gamification involves the company’s customers. It aims to understand and stimulate customer motivation, most of the times by engaging them with the company’s website or online store.

The third category, behavior change, goes outside business contexts and seeks the formation of new behaviors in a target population (or a change in existing behaviors). It can be applied in business contexts but also in other contexts.

5.3 Fields of Application

There are many areas in which Gamification has been applied. Some of the most prominent of them are healthcare and wellness, sustainability, enterprise and business, and education and training (Schlagenhauber and Ambert, 2014). Recent technological developments like real-time data analytics, mobile devices, cloud services, and social media platforms broadened the areas where the concept can be applied. A movement known as the quantified self took advantage of game elements attached to personal data tracking devices. Another more general field includes applications that deal directly with the users self-improvement and behavioral change.

The success of Foursquare\textsuperscript{10}, a location-based service and social network for smartphones, motivated several other applications and services to use game elements. The purpose was to motivate and increase user activity and retention in non-game contexts (Deterding et al., 2011). Foursquare, in its beginnings, was the most popular example of the concept of gamification by providing a reward system that encourages users to check into locations (Johnson et al., 2014a). In the ICT industry, following this success, many Internet startup companies picked up the concept and launched several gamified applications and services. How all of these gamified applications, websites and services use the concept of gamification is described in more detail in the following sections.

Since gamification is about general behavior change, most of the examples presented in the following sections may overlap.

\textsuperscript{10}\url{http://foursquare.com}
5.3.1 Healthcare and Wellness

One of the most cited successful applications of gamification is Nike+\textsuperscript{11}. Nike+ is a community of users of an application from Nike, a manufacturer of athletic shoes and sports equipment. Members of this community, almost 30 million users, are people that use the Nike+ website to record their athletic performance regarding running fitness. Users’ activities are measured by sensors in the sports shoes or by an external device like a smartphone. Those actions are converted into NikeFuel, a numeric value of performance. Users may visualize their progress and compare it with others (Figure 5.3). Users can achieve their fitness goals and travel through different status levels. Each level reflects each user’s athletic potential. Additionally, the user can accomplish different milestones, get virtual trophies and performance badges that can be shared in SNS. Also, the user can compete with his or her friends, within the community, by accessing a monthly leaderboard ranking running distances. As Blohm and Leimeister (2013) puts, “using such IT-based mechanisms, Nike has transformed endurance sports into a game” (p. 1).

Zamzee\textsuperscript{12} is another similar application but targeting a younger audience. This application is designed to motivate, measure and manage physical activity among children and teenagers. It uses a specific device, the Zamzee Meter, to track the users’ activities and measure their physical activity. Users can earn rewards, level up, take challenges

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{healthcare_wellness_nike_plus.png}
\caption{Healthcare and Wellness Example: Nike+.
}
\end{figure}

\textsuperscript{11}http://nikeplus.nike.com/plus/
\textsuperscript{12}https://www.zamzee.com/
and make friends. Similar to Zamzee, LeapFrog\textsuperscript{13} aims at kids from four to seven years old. With LeapFrog, parents can monitor their kids’ activity via a website or app and set challenges for them.

“Zombies, Run!”\textsuperscript{14} is a fitness application for mobile phones that enhances the running activity with an audio narrative. The user has to run from hunting zombies. The application reacts to how the user performs. This application also gets the underlying activity (running) to look like a game.

In the health sector, several gamified applications can be found. MoviPill is a mobile application that awards points and badges for correctly taking medicine (Blohm and Leimeister, 2013). HealthMonth\textsuperscript{15} aims the promotion of personal well-being by improving diet, fitness, mental health, relationship health, and financial health. The same goes for Foodzy\textsuperscript{16} that motivate users to improve eating habits. It uses badges, points, and social connections. Ayogo\textsuperscript{17}, a mobile behavior change platform, aims recently diagnosed patients to adopt wellness habits to reinforce a healthier life, by using game mechanics and social play.

All these examples belong to the Healthcare and Wellness domain, where many other gamification applications can be found (Muntean, 2011; Pennic, 2014; Thiebes et al., 2014). Regarding wellness and physical activity, most of the applications rely on wearable fitness devices that can help people track their daily activity, sleep, and progress towards personal goals. The gamification approach used in all the mentioned applications get people to be more active or improve their habits by motivating behavior change for a healthier life.

### 5.3.2 Sustainability

Sustainability is an ability or capacity of some system to be maintained or to sustain itself. It also concerns a trend in today’s societies that seeks ways of reducing negative human impact on the environment. It looks for ways of living in a more sustainable way. Improving lifestyles towards a reduction of human activities impact on the environment can be achieved with a gamified approach. Applying game elements in non-game environmental contexts, in order to promote environment friendly behaviors, is the purpose of a subset of gamification, known as Green Gamification. Adjustments in

\begin{itemize}
  \item \textsuperscript{13}http://www.leapfrog.com
  \item \textsuperscript{14}https://www.zombiesrungame.com/
  \item \textsuperscript{15}http://www.healthmonth.com/
  \item \textsuperscript{16}https://foodzy.com/
  \item \textsuperscript{17}http://ayogo.com/\end{itemize}
individual lifestyles can contribute to a more sustainable world. ICT play a major role by providing the gamified applications that make people act in a more sustained way.

There are several examples of green gamification applications. In the automotive industry, Carwings\textsuperscript{18} is a smartphone app for an electric car that tries to encourage an ecological way of driving (Blohm and Leimeister, 2013; Muntean, 2011) under the Nissan’s “Zero Emission” program. Many companies in the automotive industry are striving to develop eco-friendly cars to be driven by eco-friendly drivers. Eco-driving can be encouraged by using game elements (Inbar et al., 2011). As an example, Driving Curve\textsuperscript{19} is a gamified smartphone app that records users’ driving behaviors and provides feedback for efficient driving behaviors. Some electric vehicles also have a gamified dashboard for a fuel efficient drive (e.g. the Eco Assist system from Honda and SmartGauge from Ford).

Opower\textsuperscript{20} is a cloud-based platform for utility customers. The company tries that its customers understand their energy use and better manage it. The customers’ bill shows a leaderboard of energy use (with the customer and the customer’s neighbours). It also includes iconic rewards and provides a visual feedback on the customer’s behavior regarding energy consumption. Opower’s users can complete challenges, participate in groups, and earn points and badges. Ekoguru\textsuperscript{21} is a web application that rewards energy efficiency by motivating users to reduce power consumption. It has a social component by allowing each user to invite friends and neighbours to face energy saving challenges. Recyclebank\textsuperscript{22} (Figure 5.4) is an online platform that encourages users to recycle by earning points that can be redeemed for physical goods and services. Users get their points by accepting challenges (e.g. quizzes on sustainability) available on the platform. WeSpire\textsuperscript{23} (formerly known as Practically Green) is an example of another platform regarding positive behavior change in consumers and employees sustainability programs. The platform uses gamification to engage customers or a company’s employees in positive actions.

To increase the sense of purpose among the players and let them feel that they are making a difference for some cause (also as a way to keep players on board), there are systems like Recycle Bank, with the purpose of improving players behaviors like recycling their household garbage or using energy more efficiently. Several other examples of apps using gamification in sustainability can be found in Herger (2011), under the SAP Carbon Impact reward.

\textsuperscript{18}http://www.nissanusa.com/innovations/carwings.article.html
\textsuperscript{19}http://drivingcurve.com/
\textsuperscript{20}http://www.opower.com
\textsuperscript{21}http://ekoguru.com
\textsuperscript{22}https://www.recyclebank.com
\textsuperscript{23}http://www.wespire.com
5.3.3 Enterprise and Business

Gamification started its success in websites in order to create loyalty, brand awareness and marketing engagement (Muntean, 2011). In enterprise and business contexts, gamification deals mainly with a company’s human resources and marketing departments. As seen in Section 5.2.6, Werbach and Hunter (2012) identified three different gamification categories: internal gamification, external gamification and behavior change gamification. The first two are related to the application of the concept in enterprise and business contexts. Internal gamification, also called enterprise gamification, deals with a company’s human resources. It aims an improve in productivity through an improve in employees’ priductivity, retention, and engagement with the company’s values. External gamification involves the company’s customers. It aims to stimulate customers’ loyalty and brand image, keeping the customers more engaged with the company’s products (e.g. through the company’s website). Applications of gamification in business contexts are vast. Raftopoulos et al. (2015) analysed 304 publicly available case studies of organizations with undertaken gamification projects and found 17 primary purposes, from employee recruitment and training (internal gamification) to customer loyalty (external gamification).

Game elements have appeared in enterprise and business contexts for many years. Both internal and external gamification are the most aged use of gamification in business contexts. There some known examples of employes’ motivation through the use of game
elements since the first half of the last century (see the “gamification of work” in Section 5.1.1). Customer’s loyalty programs, like frequent flyer programs in airline companies, also used game elements for a long time.

An early example of external gamification in a website is Samsung Nation\textsuperscript{24} (Figure 5.5) from Samsung Electronics. The website allows customers to look at new products, provide reviews, socialize, participate in discussions with other users, watch videos, and other activities. Customers earn points and badges to reward their participation and can be ranked on leaderboards. For the company, the purpose is to increase customers’ time spent on site, user generated content and online sales.

Salesforce\textsuperscript{25}, a cloud-based CRM application, uses gamification to motivate sales teams. Manual processes have been replaced with a user-friendly sales application that displays a team leaderboard, a progress bar and featured challenges, encouraging them to achieve their short and long-term sales goals. Level Eleven\textsuperscript{26}, a sales performance platform, offers gamification plug-ins for Salesforce.com (Blohm and Leimeister, 2013). Freshdesk\textsuperscript{27} is another example of a CRM application that uses game elements in customer support by

\begin{figure}[h]
\centering
\includegraphics[width=0.8\textwidth]{samsung_nation.png}
\caption{Enterprise and Business Example: Samsung Nation.}
\end{figure}

\textsuperscript{24}http://www.samsung.com/us/samsungnation
\textsuperscript{25}http://www.salesforce.com
\textsuperscript{26}http://leveleleven.com
\textsuperscript{27}http://freshdesk.com/scaling-support/gamification-support-help-desk
motivating employees in call-centers. Freshdesk uses points, badges, leaderboards, and levels. A similar example is Playvox\textsuperscript{28}.

Keas\textsuperscript{29} is an employee wellness platform used by enterprises to maintain lower group health insurance costs and reduce expenses such as unnecessary sick days. Keas employs gamification within its platform, enabling employees from client companies to log in to a personal dashboard to view stats, earn awards for achievements for completing tasks, and even support co-workers for progress towards their goals. Keas is both in the wellness and enterprise fields.

Zao\textsuperscript{30} is another example of internal gamification applied to recruiting. Zao is a social recruiting platform with a gamification layer applied to referral programs. The platform uses game elements to encourage employees’ engagement recognizing their efforts when they proactively participate in recruiting processes.

5.3.4 Self Improvement and Behavior Change

Gamification relates behavioral change to positive emotional feedback. Since some behaviors are unconscious and automatized, by providing positive emotions, gamification may break up those existing habits, replacing them with new and better behaviors. Although all gamified applications aim some kind of behavioral change, there are several gamified applications concerning individual users self-improvement and behaviors that justifies this category. This sections presents some examples.

To track personal financial goals, Mint\textsuperscript{31} employs game features and graphical data to help users have a better understanding of their spending habits and plan for their financial future. Lift\textsuperscript{32} is a gamified system where players through the web or using a mobile application, can set personal goals to improve their habits (like doing more exercise or drinking more water, the top popular habits). Each player’s achievements can be shared with other players. Proof\textsuperscript{33} is a similar example but with a social component (the user can compete and challenge others). Users can create challenges and capture photo or video proof to show that they accomplished those challenges. Another interesting but very specific example is BahnScout, to motivate passengers of Munich’s Metro to report damages at train stations (Blohm and Leimeister, 2013).

\textsuperscript{28}http://www.playvox.com/
\textsuperscript{29}http://keas.com
\textsuperscript{30}http://www.zao.com
\textsuperscript{31}https://www.mint.com
\textsuperscript{32}https://www.lift.do/
\textsuperscript{33}https://www.mindbloom.com/proof
Targeting younger users, ClassDojo\textsuperscript{34} is a system where teachers can reward the students in their classes with positive points, rewarding desired behaviors, and negative points, punishing the undesired ones. Chore Wars\textsuperscript{35} (Figure 5.6) is a RPG-like platform to track how much housework players do and is halfway between this group of systems and the previous one. Players can just log in and claim an achievement (a predefined chore they did) and get experience points (XP). A special user, the “Dungeon Master” chooses which chores exist and their XP but this privilege can also be given to other players. Similar examples are ChoreMonster\textsuperscript{36} and Highscore House\textsuperscript{37}. A similar example is Epic Win, a smartphone app to monitor chores and reminders with a RPG setting.

\textbf{Figure 5.6: Self Improvement and Behavior Change Example: Chore Wars.}

Vivo Miles\textsuperscript{38}, is a web-based rewards system for schools, where students own their personal rewards card to store electronic points (called ‘Vivos’). These points can be exchanged for physical goods or used to skip the lunch queue. The school sets up what behaviors are to be rewarded or penalised and the teachers award students.

\subsection*{5.3.5 Quantified Self}

The Quantified Self (QS) movement, a collaboration among users and makers of self-tracking tools, was founded by Gary Wolf\textsuperscript{39} and Kevin Kelly (Whitson, 2013). According to Johnson et al. (2014a) Quantified Self (QS) “describes the phenomenon of consumers being able to closely track data that is relevant to their daily activities through the

\begin{footnotesize}
\textsuperscript{34}https://www.classdojo.com/
\textsuperscript{35}http://www.chorewars.com/
\textsuperscript{36}http://www.choremonster.com
\textsuperscript{37}http://www.highscorehouse.com - servers were shutdown on February, 23th, 2015
\textsuperscript{38}https://www.vivomiles.com
\textsuperscript{39}http://antephase.com/bio
\end{footnotesize}
The QS purpose is to derive self-knowledge through self-tracking (Paharia, 2013). This can be achieved by the use of self-tracking applications, also known as QS tools. These tools collect personally relevant information for self-knowledge (Morschheuser et al., 2013).

QS technologies include mobile apps and wearable devices, that take the form of items of clothing, watches or glasses. These devices and apps collect data in cloud-based services. Still according to Johnson et al., “people have always demonstrated interest in learning about themselves by tracking and measuring their behaviors and activities” (p. 44).

Therefore, QS settings, most of them related to fitness and health, have a large potential to apply gamification as a way to improve behavior change and increase motivation. Solitary and tedious activities can become more enjoyable (Whitson, 2013). Examples of gamified QS applications are Nike+ (which is also an example for Healthcare Gamification category), HealthMonth, FitBit, RunKeeper, RescueTime or Mint (Paharia, 2013).

The contribution of gamification to QS is the immediate feedback provided by game elements, relying on the data processing that digitized spaces made possible. These digitized spaces are, in the the most part, supported by mobile technologies, from smartphones to specific devices that can be part of the clothes that people wear.

Regarding higher education, QS was pointed in 2014 as a technology to watch in a four to five years horizon with potential impact on teaching and learning. For K-12 education, wearable devices, as part of QS technologies, were outlooked, also in 2014, as technologies to watch in the same time horizon (Johnson et al., 2014b) while games and gamification where pointed to have a time to adoption horizon of two to three years. According to these reports, QS, wearable technologies and gamification can bring important developments in ICT for schools in approximately the same time horizon.

Some pioneer work regarding the use of QS and gamification is already being done in learning contexts. Morschheuser et al. (2013) used, as a PLE, a QS tool, the Live-Interest-Meter, a mobile application that allows users in an auditorium to provide live feedback about a talk or presentation. The study concluded that gamification can increase the motivation to use QS applications to collect personal data in a learning context leading to an improvement of the learning process.

5.3.6 Education and Training

The Horizon Report 2014 Higher Education Edition (Johnson et al., 2014b) identifies video games together with gamification as one of the emerging technologies to impact
on higher education in a horizon of two to three years. Not only restricted to higher education but considering all levels of education, the education and training area has been one of the areas identified with a high potential for the application of gamification (Lee and Hammer, 2011). In fact, the education system somehow already incorporates game elements when students get points for completing assignments or when they level up to the next grade. According to Leong cited by Huang and Soman (2013, p. 24) “for students, gamification serves the purpose of minimising negative emotions that they usually encounter in traditional forms of education”. These authors also state that gamification “can be a powerful strategy when implemented properly, as it can enhance an education program, and achieve learning objectives by influencing the behaviour of students” (p. 24).

The gamification of education approach has the advantage of introducing what really matters from the world of video games without using any specific games. Unlike the GBL and the serious games approaches, the purpose of gamifying education is to find the elements that make good games enjoyable and fun to play, adapt and use them in learning contexts. Thus, students learn, not by playing specific games but they learn with the feeling that they are playing games. Monterrat et al. (2014) point some differences between a learning game and a gamified learning application: a learning game is designed as a game from the beginning and a gamified application is the result of the addition of game elements to an existing learning application. Byl (2013) shows some of games’ features that can be useful for learning settings:

- Games provide a positive relation with failure;
- Concrete challenges tailored to a player’s skill level with increasing difficulty;
- Players can keep trying until they succeed;
- Games provide rapid feed-back cycles;
- Games provide multiple routes to success.

Since education and training are considered as main applications areas for gamification, they have their own gamification’s specific definitions:

- “Incorporating game elements into a non-gaming software application to increase user experience and engagement [in non-gaming educative contexts]” (Domínguez et al., 2013);
- “Simple gameplay to support productive interaction for expected types of learners and instructors” (Rughinis, 2013a);
• “Using game-based mechanics, aesthetics and game thinking to engage people, motivate action, promote learning, and solve problems” (Kapp, 2012);

• “The addition of elements commonly associated with games (e.g. game mechanics) to an educational or training program in order to make the learning process more engaging” (Landers and Callan, 2011).

Many teachers and schools already use games’ features, with or without the support of ICT. The next section explains how they approach the concept’s application and gives some examples of the use of gamification in educational settings.

5.4 Application in Education and Training

5.4.1 Gamifying the Classroom

Several teachers and even some schools are already using gamification in their classes. (Dicheva et al., 2015) identified several approaches on how gamification has been used in the classroom:

- No e-learning platform or other software used;
- Manual collection of data on student performance and processing it with a computer program;
- Software for supporting gamification implemented as a plugin or extension of a LMS or other online learning environment;
- Third party software used to support some aspect of gamification;
- Software for supporting gamification implemented as standalone applications.

In the first approach, teachers may, for example, just collect class data and use it to build leaderboards. Concerning the second approach, teachers use spreadsheets and other digital tools to gather manual collection of data, again mainly to generate leaderboards. Systems like LMSs and other online platforms can be used with plugins for gamification software in the third approach. Several third party software can also be used to support gamification as pointed out in the fourth approach. The last approach refers to some experiences where specific gamification software was developed.

Another approach is the use of some of the already existing gamified LMSs. Some of those platforms are Curatr, Playdea, 3D GameLab, a gamified quest-based platform or
Chapter 5. Gamification Fundamentals

ExpertusONE, to name a few. These and other examples of LMS that include gamification features are shown on Table 5.1.

Table 5.1: Gamified Learning Management Systems

<table>
<thead>
<tr>
<th>LMS</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curatr</td>
<td><a href="http://www.curatr3.com">www.curatr3.com</a></td>
</tr>
<tr>
<td>Playdea</td>
<td><a href="http://www.playdea.com.br">www.playdea.com.br</a></td>
</tr>
<tr>
<td>3D GameLab</td>
<td>3dgamealab.org.shivtr.com</td>
</tr>
<tr>
<td>ExpertusONE</td>
<td><a href="http://www.expertus.com/expertusone-gamification/">www.expertus.com/expertusone-gamification/</a></td>
</tr>
<tr>
<td>Accord</td>
<td><a href="http://www.accordlms.com/smart/gamification">www.accordlms.com/smart/gamification</a></td>
</tr>
<tr>
<td>Talent</td>
<td><a href="http://www.talentlms.com/">www.talentlms.com/</a></td>
</tr>
<tr>
<td>Academy</td>
<td><a href="http://www.growthengineering.co.uk/academy-lms/">www.growthengineering.co.uk/academy-lms/</a></td>
</tr>
<tr>
<td>Schoology</td>
<td><a href="http://www.schoology.com">www.schoology.com</a></td>
</tr>
<tr>
<td>Learning@Work</td>
<td><a href="http://www.saba.com">www.saba.com</a></td>
</tr>
</tbody>
</table>

As examples of third party software, several web applications for education are available like ClassDojo (already mentioned in Section 5.3.6), GoalBook, to track students’ progress or ClassBadges, a tool to award badges. Classcraft uses levels and points and was designed to look like the game World of Warcraft, a MMORPG. Most of these applications, like the given examples, just consider a single game element. Several other educational tools can be found like ClassDojo or VivoMiles, also mentioned on Section 5.3.6, or Zondle, a classroom management platform with several game elements. These and other examples are shown on Table 5.2.

Table 5.2: Gamification Tools for Education

<table>
<thead>
<tr>
<th>Tool</th>
<th>URL</th>
<th>Game Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>ClassXP</td>
<td><a href="http://www.classxp.org">www.classxp.org</a></td>
<td>Points and Levels</td>
</tr>
<tr>
<td>ForAllRubrics</td>
<td><a href="http://www.forallrubrics.com/">www.forallrubrics.com/</a></td>
<td>Badges</td>
</tr>
<tr>
<td>Open Badge Designer</td>
<td><a href="http://www.openbadges.me">www.openbadges.me</a></td>
<td>Badges</td>
</tr>
<tr>
<td>Classbadges</td>
<td>classbadges.com</td>
<td>Badges</td>
</tr>
<tr>
<td>Mozilla OpenBadges</td>
<td>openbadges.org/</td>
<td>Badges</td>
</tr>
<tr>
<td>GoalBook</td>
<td>goalbookapp.com/</td>
<td>Goals</td>
</tr>
<tr>
<td>Voki</td>
<td><a href="http://www.voki.com/">www.voki.com/</a></td>
<td>Avatares</td>
</tr>
<tr>
<td>Rise</td>
<td><a href="http://www.rise.global">www.rise.global</a></td>
<td>Leaderboards</td>
</tr>
<tr>
<td>Utopsia</td>
<td>betalist.com/startups/utopsia</td>
<td>Leaderboards</td>
</tr>
<tr>
<td>Classroom Carrots</td>
<td><a href="http://www.classroomcarrots.com">www.classroomcarrots.com</a></td>
<td>Points and Rewards</td>
</tr>
<tr>
<td>ClassDojo</td>
<td><a href="http://www.classdojo.com">www.classdojo.com</a></td>
<td>Points and Rewards</td>
</tr>
<tr>
<td>VivoMiles</td>
<td><a href="http://www.vivoclass.com/">www.vivoclass.com/</a></td>
<td>Points and Rewards</td>
</tr>
<tr>
<td>Zondle</td>
<td><a href="http://www.zondle.com">www.zondle.com</a></td>
<td>Several game elements</td>
</tr>
<tr>
<td>Kahoot</td>
<td>getkahoot.com/</td>
<td>Game-based response system</td>
</tr>
<tr>
<td>PlayBrighter</td>
<td>playbrighter.com/</td>
<td>Game-like classroom management</td>
</tr>
</tbody>
</table>

5.4.2 Examples

According to Farber (2015), one of the first widely known examples of a game like environment was the approach used by Sheldon (2012). Instead of using percentages in
his grading system, Sheldon used a game element, experience points, also known as XP, a common element in MMORPG’s. Students start with 0 XP and, as they advance, they get more points and “level up”. Students also get extra points for attending to classes. This approach was inspired by MMORPG’s.

There are other experiences already on the field, like the Khan Academy (Figure 5.7), a non-profit project that applies several game mechanics, like achievement badges and points, with the goal of a better education for all. Another example is Quest to Learn\footnote{http://www.instituteofplay.org/work/projects/quest-schools/quest-to-learn/} (Farber, 2015), a public school in the United States that is using “game-like learning” as a way to empower and engage students. Quest to Learn is an example of an entire school adopting gamification principles. In this school, the entire structure of learning is gamified and the entire learning process is a game. Some classroom experiences are also known like the Paul Andersen experiences (Anderson, 2011). Kaplan University\footnote{http://badgeville.com/customer/case-study/kaplan-university} implemented Badgeville (see Section 5.6) solutions aiming a more engaged participation of students. Game elements like challenges and badges were used. Student got better grades and the number of students failing to complete courses decreased. Johnson et al. (2014b) also mention the experience in the Le Sale’sien High School in Quebec. This school used Classcraft (see previous section) that proved to be an effective tool to keep students motivated.

Regarding informal learning settings, Treehouse\footnote{http://teamtreehouse.com/}, is an example of an online gamified platform to develop skills in web design, web development and mobile applications development. Treehouse’s users are rewarded with badges by overcoming challenges. A similar example is CodeAcademy\footnote{http://www.codecademy.com}. Stackoverflow\footnote{http://stackoverflow.com/} is another online platform where programmers can share knowledge and gain status, points and badges by helping others. Duolingo\footnote{https://www.duolingo.com/} is another example of an informal learning gamified application. Duolingo is a language teaching application for smartphones and web browsers and a crowdsourced text translation platform. Users can learn a language, earning skill points when lessons are completed. A user can also vote on the quality of other users’ translations.

### 5.5 Gamification Frameworks

Since the word gamification got the attention of the academy and industry, several aptents were proposed to sistematize its application in several domains. Most of those
attempts were named as frameworks. However, most of the known proposals do not follow the features and the definition that are considered in this thesis for what should be understood as a gamification framework, as it will be discussed in Chapter 8. Nevertheless, the thesis’ literature review found several proposals of process and guides referenced as frameworks. Those proposals are described in the following sections.

### 5.5.1 GOLF

The Game-Oriented Learning Framework (GOLF) was proposed by (Charles, 2010). This framework comprises six key engaging elements:

1. Fun: “engagement is easier if the experience is enjoyable”;
2. Social: “engagement is reinforced by the social support of others going through the same experience”;
3. Identity: “engagement can be encouraged if everyone has a visible role in the learning environment”;

**Figure 5.7:** Education and Training Example: Khan Academy.
4. Challenge: “engagement can build on human competitive drive, enhanced by social pressure”;

5. Structure: “engagement is more likely if objectives and constraints are clear and acceptable”;

6. Feedback: “engagement is reinforced by making achievement explicit”.

The work of (Charles, 2010) does not make any mention to gamification (in 2010 the term was starting to be used in digital media), but it mentions that “student performance in e-learning can be improved by using engagement techniques from digital games. Essentially, this means enhancing technology-oriented learning environments with engaging features that occur in game design”. This statement can be considered a valid definition for gamification of education. Therefore, the research made by Charles is a pioneer work concerning educational gamification frameworks. The author also emphasizes that GOLF approach intends to make the teaching process like a game but not the teaching contents (similar to the structural gamification category proposed by Kapp et al. (2014), as seen in Section 5.2.4).

It is important to notice that GOLF considers important features, like competition and collaboration, as part of the social component of the experience. Social recognition, clear and acceptable goals, feedback and fun are other important elements. GOLF gives important hints about the key or core concepts that a gamification framework must consider. However, GOLF does not concern any features for a supporting gamified system.

GOLF was evaluated and refined through a series of case studies. This evaluation was lead by the research question “student performance in e-learning can be improved by using engagement techniques from digital games”. Charles concluded that the framework proved its effectiveness and was successful in encouraging and motivating students to participate in learning processes.

### 5.5.2 Werbach and Hunter

A six step design framework was proposed by Werbach and Hunter (2012) for developing gamified systems:

1. Define business objectives;

2. Delineate target behaviors;

3. Describe the players;
4. Devise activity cycles;
5. Don’t forget the fun;
6. Deploy the appropriate tools.

The emphasis is on the design of the system and all the steps start with the letter D, like the word design itself. Werbach and Hunter’s proposal is just a guide with general steps about how to gamify a system. This framework focuses on players and their behaviors concerning some objectives in the non-game context. The proposal also focuses on activity cycles, emphasizes the importance of fun and the importance of choosing the proper game elements. Werbach and Hunter mention two types of activity cycles: “engagement loops” and “progression stairs”. “Engagement loops” stress the importance of feedback, considering that all the game components can be seen as forms of feedback. “Progression stairs” reflect the players’ progression in relation to the players’ skills. The player’s journey through the gamified setting should be a collection of short-term missions and long term goals. Game levels are a game element able to implement this kind of activity cycle. “Progression stairs” cycles are similar to the notion of player’s journey (Section 5.5.5).

5.5.3 Marczewski

Marczewski (2012) proposed a sequence of steps (eight questions that the system designer must place himself) to develop a gamified system:

- What is being gamified;
- Why is it being gamified;
- Who are the users;
- How is it being gamified;
- Analytics are set up;
- Tested with users;
- Acted on feedback;
- Released the solution.

This framework considers an iterative development process where steps six and seven are in a loop and, as a whole, also steps five to eight can be repeated in a loop. The
framework also considers the social component (playing with other people) and fun (to make the system more enjoyable). Marczewski also mentions the importance of intrinsic motivation, more powerful than extrinsic motivation, and the importance of a gamification designer to think like a game designer. Although, none of the above steps deals with the players’ behaviors.

5.5.4 Octalysis

Octalysis defines a set of eight fundamental motivators of behavior (core drives) which influence human activities. These motivators are presented in the form of an octagonal graph (see example on Figure 5.8). The Octalysis core drives are:

- Epic Meaning & Calling;
- Development & Accomplishment;
- Empowerment of Creativity & Feedback;
- Ownership & Possession;
- Social Influence & Relatedness;
- Scarcity & Impatience;
- Unpredictability & Curiosity;
- Loss & Avoidance.

An online tool[^octalysis-tool] is available to test a product or servide under Octalysis assumptions. In the Octalysis graph, the core drives on the right (named as “right brain core drives”) are more related to creativity, self-expression, and social aspects. The core drives on the left (“left brain core drives”), are more related to logic, calculations, and ownership. The top core drives are considered as positive motivations, while the bottom core drives are considered as negative motivations.

To use Octalysis and its online tool, the product or service’s game elements and game techniques are identified and associated to each core drive. Each core drive has a scale (between 0 and 10) and the elements and techniques are listed next to the corresponding core drive. Then, each side of the graph will expand or retract, according to the score of each game element or technique. An overall score is computed by summing the squares of the score of each core drive. Figure 5.8 shows the result obtained, by Octalysis’

[^octalysis-tool]: http://yukaichou.com/octalysis-tool/
author, for FarmVille, a popular social game. This is a very subjective process with lack of any scientific foundations. Although, Octalysis points for some important core concepts and the online tool gives some insights about the purpose of each element and technique. Octalysis could be an interesting marketing tool but cannot be considered as a solid framework. Is is also an analysis tool of existing gamification applications and does not concern about what is needed to build those applications.

5.5.5 Player’s Journey Framework

Kim (2011, 2014b) proposed the Player’s Journey framework (Figure 5.9), focused on the player’s experience (the players’ progression over time) and under what its author calls Smart Gamification. Players are considered under three categories: Newbies, Regulars and Enthusiasts. The framework is built around three key stages of the player’s experience (Kim, 2014b):

- “Onboarding: the initial Newbie experience that teaches the ropes and sets expectations for what’s to come”;
• “Habit-building: the triggers, activity loops and feedback systems that turns Newbies into Regulars”;
• “Mastery: the ‘elder game’ that opens up to Enthusiasts who’ve mastered the system and want to go deeper”.

![The Player Journey Framework](Adapted from Kim, 2014b)

The framework comprises five steps for the design of engaging systems:

1. Insight, concerning the early adopter players and how they like to interact;
2. Motivation, about the needs players want to satisfy and they feel intrinsically rewarded;
3. Lifecycle, regarding the system’s evolution in time;
4. Progress, meaning the players’ progress to achieve mastery;
5. Loops, about how to engage players during their journey.

### 5.5.6 Player Centered Design Methodology

Kumar and Herger (2013) proposed a player centered design methodology with five steps. This methodology is focused on the enterprise context and aims to apply gamification in business software. The players are at the center of the design and development process. It also addresses legal and ethical considerations and points out that the gamified systems must be able to stimulate positive emotions in the players, like fun. The steps of the Player Centered Design are:
Chapter 5. *Gamification Fundamentals*

1. Know your player;
2. Identify the mission;
3. Understand human motivation;
4. Apply mechanics;
5. Manage, monitor and measure.

**Kumar and Herger**’s methodology starts with the importance of players characterization. The notion of mission refers to the goal set for the gamified activity. The authors use the acronym SMART (Specific, Measurable, Achievable, Realistic, and Time bound) to highlight the features that must be considered in the mission statements. Step three focuses on human motivation and its importance in creating an effective gamified experience. The term “mechanics” in step four is a mixture of game elements and game techniques. The last step of the methodology stresses the deployment of a gamified solution as an iterative process. Setting the proper metrics or Key Performance Indicators (KPI), and the collection of gamification data must be considered in this iterative process.

### 5.5.7 Huang and Soman

**Huang and Soman** (2013) proposed a five-step process to apply gamification in education:

1. Understanding the target audience and the context;
2. Define learning objectives;
3. Structuring the experience;
4. Identifying resources;
5. Applying gamification elements.

This proposal also considers the break down of the learning program into separate milestones and the use of a currency-based tracking mechanism, where currency is a unit of measure like points or time. This tracking mechanism, along with a set of rules, allow the development of levels and provide feedback. Like the majority of the other frameworks’ proposals, **Huang and Soman**’s (2013) five-step process is just a general guide to apply gamification without empirical evidence of its effectiveness.
5.5.8 Other Approaches

The Gamification Sensing Framework proposed by Fitz-Walter (2015) is a three-layered framework that adds video game-like achievements to a mobile application used by university students. The framework relies on sensors available in mobile technology. These sensors are the interface between the gamified system and the non-game context. This proposal divides the gamification design into three parts: goals (what the designers aim to address), sensing (triggers using available sensing and linking goals with game elements) and game (the game design elements supporting the goals). The Gamification Sensing Framework addresses a specific kind of gamified applications; the ones where some devices act as a mediator with the non-game context.

Gonzalez and Mora (2014) used a five steps method to gamify an activity in educational context. The steps were the following: 1. Analysing users and environment; 2. Defining learning objectives; 3. Designing the experience; 4. Identifying resources; and 5. Applying gamification elements. The method was tested in a higher education context.

Kapp (2012) proposed a methodology (Gamification Design Process) based on a sequence of steps to guide the design of gamified systems. This proposal is, however, a more restrictive approach since the considered gamified systems are essentially serious games.

Some commercial proposals can also be found like the one proposed by Playify47, a swedish company that sells a deck of cards to help the design of gamified experiences. The process has four main steps: 1. Define the target audience; 2. Find a challenge for the players; 3. Choose and apply game mechanics; and 4. Choose the types of feedback and rewards. The cards provide guidance through these steps.

Most of the above frameworks (from Section 5.5.1 to the present section) were also found in the Mora et al.’s (2015) review of gamification design frameworks. The study found that most of the proposals are human-based, taking the person (the designer) as the centre of the design process.

5.6 Commercial Gamification Platforms

The first known gamification platform was introduced by Bunchball, a company founded in 2005 (Schlagenhaufer and Ambert, 2014). Bunchball started to offer gamification services and products before the term gamification become known. After Bunchball, several other companies started offering gamification solutions, mainly for marketing

47http://playify.se
and customer loyalty purposes. After this first focus on the enterprise, the offer of gamification services and products expand to other areas.

Most of the gamification products are cloud-based. They use the Software as a Service (SaaS) approach, running on the Internet, offering customers a solution with minimal coding. Mobile solutions are also available. The main features of these gamification platforms are reward and reputation systems with game elements like points, badges, levels and leaderboards. Most platforms allow their users to access services from any Internet connected device. Another common feature are built-in analytics systems with metrics about users’ interactions.

The biggest players in the gamification market, are Badgeville, Bigdoor, Bunchball (the three biggest companies) or Gygia and other smaller ones like tierX, PunchTab or Up-laude provide the tools to power websites, blogs and web applications and some of them offer complete sets of gamification products\footnote{An extensive list of gamification platforms is available at http://www.enterprise-gamification.com/index.php?option=com_content&view=article&id=60&Itemid=30&lang=de} (Table 5.3).

<table>
<thead>
<tr>
<th>Platform</th>
<th>URL</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bunchball</td>
<td><a href="http://www.bunchball.com/">www.bunchball.com/</a></td>
<td>Customer and employee engagement</td>
</tr>
<tr>
<td>Badgeville</td>
<td>badgeville.com/</td>
<td>Mainly customer and employee engagement</td>
</tr>
<tr>
<td>Bigdoor</td>
<td>bigdoor.com/</td>
<td>Customer and employee engagement</td>
</tr>
<tr>
<td>Gygia</td>
<td><a href="http://www.gigya.com/">www.gigya.com/</a></td>
<td>Customer engagement</td>
</tr>
<tr>
<td>3radical</td>
<td><a href="http://www.3radical.com">www.3radical.com</a></td>
<td>Mobile, marketing and consumer engagement</td>
</tr>
<tr>
<td>CaptainUp</td>
<td>captainup.com</td>
<td>General use; SaaS</td>
</tr>
<tr>
<td>Gametize</td>
<td>gametize.com/</td>
<td>Self-improvement</td>
</tr>
<tr>
<td>Gameffective</td>
<td><a href="http://www.gameffective.com">www.gameffective.com</a></td>
<td>Customer engagement</td>
</tr>
<tr>
<td>Gamygame</td>
<td><a href="http://www.artmobile.es">www.artmobile.es</a></td>
<td>Mobile platform; marketing</td>
</tr>
<tr>
<td>Jugo</td>
<td>playjugo.com</td>
<td>Employee and customer engagement</td>
</tr>
<tr>
<td>Playbasis</td>
<td><a href="http://www.playbasis.es">www.playbasis.es</a></td>
<td>Customer engagement</td>
</tr>
<tr>
<td>Playlyfe</td>
<td>playlyfe.com/</td>
<td>SDK, development tool, game engine</td>
</tr>
<tr>
<td>Punchtab</td>
<td><a href="http://www.punchtab.com/">www.punchtab.com/</a></td>
<td>General use; SaaS</td>
</tr>
<tr>
<td>SessionM</td>
<td><a href="http://www.sessionm.com/">www.sessionm.com/</a></td>
<td>Customer engagement; Mobile platform</td>
</tr>
<tr>
<td>Uplaude</td>
<td><a href="http://www.uplaude.com/">www.uplaude.com/</a></td>
<td>General use; SaaS</td>
</tr>
<tr>
<td>Userinfuser</td>
<td>code.google.com/p/userinfuser/</td>
<td>Open source</td>
</tr>
</tbody>
</table>

### 5.7 The Downside of Gamification

Game developers and game theorists often criticise gamification, but the concept is also questioned by ICT industry professionals. Gamification detractors often say that the term is a buzzword mostly used as a marketing tool (Chorney, 2012; Thiebes et al., 2014). For them, gamification just takes some ineffective game elements that are not
sufficient to motivate people. Still according to Thiebes et al., Gartner predicted that the majority of the first gamified applications would fail due to this ineffective design.

Critics have accused gamification implementations to be excessively superficial, based on PBL/BLAP elements, used as simple extrinsic motivators. This approach is often called “badgification” or “pointsification” (Robertson, 2010). To stress the irrelevance of a simple PBL/BLAP approach, an online game, Progress Wars\(^{49}\), demonstrates that if the activity is not seen by the players as interesting and engaging, they will not be engaged just by the use of such elements. In the game, the player just have to click a button and watch a progress bar evolving (without any underlying meaning). Progress Wars is mentioned by gamification detractors to argue that gamification is pointless. Also, Robertson (2010) argues that what we’re currently terming gamification is in fact the process of taking the thing that is least essential to games and representing it as the core of the experience. Points and badges have no closer a relationship to games than they do to websites and fitness apps and loyalty cards.

This view is similar to what some videogame theorists claim. For Bogost (2011b), the power of games does not come from the PBL/BLAP elements commonly found in gamified applications and fail to apply the real qualities of games: “gamification mistakes games’ secondary properties for their primary ones”. Bogost argues that this approach would be more properly termed as “exploitationware”.

He also argues against social games that inspired many gamification implementations. To support his opinion, he created a game, Cow Clicker\(^ {50}\), as a satire of this kind of games. Chorney (2012) also claims that social games cannot be considered as real games thus devaluing gamification implementations based on elements and techniques from this type of games.

Regarding education, although some successful examples exist (see Sections 5.4.2 and 7.4), there is still a controversy about the use of gamification. Most of the criticism, again, has to do with the view of the concept that only appeals to extrinsic motivation (Ely, 2011; Silvers, 2011). Focusing only on extrinsic motivation is far from what many scholars advocate for education (e.g. Khon cited by Pink, 2009). For them, the use of rewards to motivate behavior only motivates people to win new rewards and not to develop the behavior that is being rewarded. Rewards only work for unpleasant or boring tasks. If a reward is added to the completion of a task that the person is intrinsically motivated to do, the willing to perform that task decreases. Kohn presented\(^ {49}\)\texttt{http://www.progresswars.com/}
\(^ {50}\)\texttt{https://apps.facebook.com/cowclicker/}
several examples of how incentives can reduce motivation. Also, some teachers may see
gamification as a less serious approach to education considering that the classroom must
be a place to work and learn and not a place for games and fun.

Hence, main critics around gamification focus on the simplistic and superficial approach
found in many gamified applications. For them, these applications use game elements to
appeal solely to extrinsic motivation and are not able to create meaningful experiences
that motivate long-term behavior change. Gamification can offer short-term gains but
is unable to provide long-term benefits. Although, this view does not concern with the
validity of the concept but with the way is has been applied. Pitfalls are also pointed.
For some opponents, gamification is considered as manipulative and unable to change
behaviors (Bogost, 2011b; Chorney, 2012). Gamification is seen as a way for companies
get more money from their customers and to collect their personal information to create
personalized advertisements. Critics also point that gamification neglects the power of
story (what matters in video games) arguing that what defines a game are not the PBL
elements but the contents and the storyline.

5.8 Summary

This chapter presented an overview of gamification, covering several existing definitions
for this concept, its origin and evolution and some different categories that have been
proposed.

To be effective on a long-term basis, gamification must be more than just adding
PBL/BLAP elements to a non-game context. A good gamified system should also act
on the intrinsic motivation of the players. If a person performs a task for the task’s
own sake, it means he or she is intrinsically motivated to perform that task. This is
what happens when people play games. Gamification, in its quest to generate a game-
like level engagement in non-gaming contexts, must create a meaningful experience and
not only rely on commonplace extrinsic rewards, an approach known as “meaningful
gamification”.

Gamification expanded to many different areas. Healthcare and wellness, sustainability,
enterprise and business, self-improvement and behavior change, the quantified-self ap-
proach and education and training are some of the fields where gamification has been
successfully applied. Gamification has a remarkable potential in education and train-
ing, and can create a wide range of opportunities for research and a market for new
educational tools and technological platforms. Assuming that children and teenagers
like to play video games but are not sufficiently engaged in school activities, leading
to demotivation, gamification of education is a process to induce motivation in those activities and to get students engaged by changing their behaviors. But there is still little empirical evidence about the benefits of using gamification in the classroom and in corporate training.

Gamification in education and training is another way to use game thinking and game elements to promote engagement, increase motivation and make learning fun. Gamification has a great potential to motivate students and make school more attractive. It has the advantage of introducing what really matters from the world of video games - increasing the level of engagement and fostering motivation - without using any specific game.

Several gamification platforms and tools were listed in this chapter, particularly in the educational field. The thesis literature review found some methodologies and step-by-step guides, named by their authors as “gamification frameworks”. These existing proposals were described in this chapter. Finally, there are many voices in the academia and in the industry that disagree with the hype around gamification. Some of those critiques were also presented in this chapter.
Chapter 6

Gamification and Psychology

Several theoretical frameworks, theories and research in the field of psychology have been discussed to justify and help understand the benefits of the use of games and game elements in non-game contexts. An understanding of psychology theories is vital for the design of gamified systems. This chapter discusses how these theories and approaches are related and how they can contribute to a gamification framework that supports the design of gamified applications. The relation of those theories and approaches with education is also referred.

6.1 The Role of Motivation and Behavior Change

As Werbach and Hunter (2012) remarks, gamification can be seen as “a means to design systems that motivate people to do things” (p. 31). Also Schlagenhauf and Ambert (2014) point that the purpose of gamification “is to motivate desired user behavior” and as motivation and behavior are studied in psychology, an understanding of psychology theories is vital and inevitable in the design of gamified systems.

The approaches from psychology concerning peoples’ motivation try to understand what motivates people to act, how peoples’ behaviors can be changed, why people enjoy doing some things and do not like to do other things, how to keep people motivated and engaged in an activity and what are the right incentives to keep them engaged. Knowing the answers to this questions is mandatory in the design of a gamified system.

Schlagenhauf and Ambert (2014) conducted a research that provided an overview of psychology theories mentioned in academic papers concerning the use of gamification in Information Systems (IS). They concluded that a vast set of 30 theories were applied
but most of them were exclusively mentioned in one article. Most of the theories examine behavior in general or intrinsic motivation. The theories that were mentioned in more than one article and aim intrinsic motivation were the Self Determination Theory (Section 6.3), and the Flow Theory (Section 6.5).

### 6.2 Intrinsic and Extrinsic Motivation

The dichotomy of intrinsic and extrinsic motivation and their relation to games are in the core of the conceptualizations concerning gamification. How to motivate people and improve their behaviors, being the ultimate goals of gamification, leads to a deeper understanding of the psychological mechanisms that move people to act. According to the intrinsic and extrinsic motivation approach it can happen in two different but related ways: people are said to be **intrinsically motivated**, when they do something because it is inherently interesting or enjoyable and they are **extrinsically motivated** when they do something because it leads to a separable outcome (Ryan and Deci, 2000). According to Malone (1980), “an activity is said to be intrinsically motivated if there is no obvious external reward associated with the activity” and it can be considered as “extrinsically motivated if engaging in the activity leads to some external rewards like food, money, or social reinforcement” (p. 3). The behaviorist approach to human motivation considered that extrinsic motivation was the right way to make people do things: reward the proper behaviors and punish the wrong behaviors (Werbach and Hunter, 2012). The anticipation of a reward will reinforce a desired behavior. According to behavioral psychology, organism behaviors occur as responses to stimuli (Lewis, 2013). Opposing to this perspective, the cognitivist approach considers that people can also be inherently motivated and do something for the pleasure of doing it.

The discussions about this dichotomy usually claim that intrinsic motivation lead to a deeper engagement with an activity in a long-term basis, rather than a more shallow engagement and for a shorter period that can be achieved with extrinsic motivation. Furthermore, research showed that when people do something for its own sake, meaning that they are intrinsically motivated to do it, if a reward or some other form of an extrinsic incentive is given, then people will decrease their motivation (Mekler et al., 2013; Werbach and Hunter, 2012). If a task is already interesting and enjoyable, adding some kind of extrinsic rewards will decrease motivation. Hence, extrinsic motivation undermine intrinsic motivation (Knaving and Bjork, 2013; Malone, 1981).

Considering intrinsic motivation as being somehow superior to extrinsic motivation is one of the main arguments of gamification critics. The usual game elements found in
gamified applications, the PBL/BLAP elements, are seen as just different forms of extrinsic rewards, therefore, only dealing with the players’ extrinsic motivation (Mekler et al., 2013). But, on another hand, extrinsic motivation is still useful to engage people if the activity being performed has no possible intrinsic motivation or if people consider the activity without any intrinsic value. Furthermore, Mekler et al. conducted a study about the effect of points, badges and leaderboards and concluded that intrinsic motivation remained unaffected in the presence of these game elements, contradicting earlier findings. Another conclusion was that these game elements, by themselves, did not increase intrinsic motivation. According to this study, PBL/BLAP elements are neutral in their relation to intrinsic motivation, if used just as rewards. They can be useful when applied to tedious or repetitive activities, regarded with no intrinsic value.

The lesson learned from games is that people play games without any tangible extrinsic rewards. Therefore, moving the game components that motivate people to those activities with no intrinsic value (or perceived as that), can enhanced engagement and motivate people to perform them. The PBL/BLAP elements, looked as a way to provide immediate feedback, which is an element of flow (see Section 6.5) or as a way to recognise an achievement, can make a contribution to intrinsic motivation.

Concerning the application of intrinsic motivation in education and its relation to games, Malone (1980) was one of the first researchers that saw “game-like activities on computers as a source of insight for designing intrinsically motivating instructional environments”. Others, noted the dangers that the use of external rewards can cause in educational settings (Kohn cited by Werbach and Hunter, 2012), revealing that gamification process in education should not be focused on improving extrinsic motivation. Muntean (2011), about the gamification of e-learning, argues that the gamification process does not intend to replace the intrinsic motivation of students by the extrinsic motivation but, instead, the process must offer a combination of the two kinds of motivation for a better performance.

### 6.3 Self-Determination Theory

The Self-Determination Theory\(^1\) (SDT), proposed by Deci and Ryan (1985) is a framework for the study of human motivation and personality. SDT is a theory of motivation. It distinguishes the two different kinds of motivation: intrinsic and extrinsic motivation, discussed in the previous section. SDT deals with the extrinsic forces acting on persons and with the intrinsic motives and needs inherent in human nature. Hence, SDT focuses on three psychological basic innate needs:

\[^{1}\text{http://www.selfdeterminationtheory.org/theory}\]
• **Autonomy**: the feeling that a person has of control over an action with the ability to determine the outcomes of that action;

• **Competence**: (or mastery) is the need for challenge and a feeling of being effective performing an activity;

• **Relatedness**: the experience to be connected to others. It involves social connection and the desire to interact and be involved with others.

According to Kapp (2012), these three psychological needs are usually present in games and therefore are responsible for the engagement and wellness that players feel. Tasks that include these innate needs will tend to be considered as intrinsically motivated (Werbach and Hunter, 2012) and more self-determined (Ryan and Deci, 2000). Werbach and Hunter made a connection between SDT and gamification by stating that game elements like points and levels can be associated with competence and mastery. Autonomy can be achieved in gamified contexts by giving players choices as they progress. Relatedness can be achieved with social games’ elements and by sharing achievements on SNS. They also point that games still have extrinsic motivators and that they can also be powerful and be used to change people’s behavior.

SDT has been applied in many domains including education and virtual environments. Regarding education, Ryan and Deci (2000) point to the lack of intrinsic motivation in school activities and how this problem is addressed by SDT:

> Given that many of the educational activities prescribed in schools are not designed to be intrinsically interesting, a central question concerns how to motivate students to value and self-regulate such activities, and without external pressure, to carry them out on their own. This problem is described within SDT in terms of fostering the internalization and integration of values and behavioral regulations. Internalization is the process of taking in a value or regulation, and integration is the process by which individuals more fully transform the regulation into their own so that it will emanate from their sense of self. (p. 60)

Considering that “internalization and integration are the processes through which extrinsically motivated behaviors become more self-determined” (p. 65), Ryan and Deci show how the three basic human needs (autonomy, competence and relatedness) contribute to a more self-determined learning:
... social contextual conditions that support one’s feelings of competence, autonomy, and relatedness are the basis for one maintaining intrinsic motivation and becoming more self-determined with respect to extrinsic motivation. We pointed out that in schools, the facilitation of more self-determined learning requires classroom conditions that allow satisfaction of these three basic human needs—that is that support the innate needs to feel connected, effective, and agentic as one is exposed to new ideas and exercises new skills. (p. 65)

Kapp (2012) summarizes how the SDT can impact the gamification of learning and instruction by stating that the theory aims to provide learners with the opportunities for autonomy, a feeling of competence and relatedness with others.

6.4 Fogg Behavior Model

The Fogg Behavior Model\(^2\) (FBM) is a model for understanding human behavior, proposed by Fogg (2009). According to this model, three elements must converge at the same time for a target behavior to occur: motivation, ability and triggers (Figure 6.1). A behavior is a product of these three factors that must occur at the same time. To perform some desired target behavior, a person must be sufficiently motivated, must have the ability to perform the behavior and must be triggered to perform it. The FBM is a conceptual framework with relevance to persuasive technology, defined by Fogg as a kind of technology to automate behavior change.

In the FBM, there is a balance between motivation and ability. Ability is a factor that influences the occurrence of a behavior. Motivation alone does not get people to perform a behavior because they must also have the ability to perform it. Even if a person is highly motivated, a behavior cannot occur if the person does not have the ability. But if the motivation is high enough the person can find the means to gain the needed ability. However, a person with low motivation can perform the target behavior if the behavior is simple, meaning that the person has a high ability to perform it. Fogg also uses the word simplicity with the same meaning as ability, considering that ability is the same of making the behavior simpler to do.

Still, motivation and ability are not enough to determine a behavior. The third element of FBM – the trigger – is also needed. A trigger is something that tells a person to perform a behavior at a certain time. In the FBM there are three different types of triggers: a spark, to be used when a person lacks motivation, a facilitator, to be applied

\(^2\)http://www.behaviormodel.org
when the person is motivated but has not enough ability, and a *signal*, to be used when a
person has both high ability and high motivation and need to be reminded to perform the
behavior. The trigger must lead the person to surpass the behavior activation threshold
(See Figure 6.1).

![Fogg Behavior Model](image)

**Figure 6.1**: Fogg Behavior Model (FBM). Adapted from Fogg (2009).

Figure 6.1 shows a graphical representation of the FBM. Since the model is conceptual
there are no units on the axes and the representation just intends to show the relation
between the three components of the model. The horizontal axis shows ability. Low
ability is marked on the left and high ability on the right. The vertical axis shows
motivation. Lower motivation is marked on the bottom of the axis and high motivation
on the top. The trigger completes the representation showing that a threshold must
be overpassed to reach the desired behavior. The three elements are represented as a
product meaning that all of them must be present to reach the target behavior.

There are some examples of research about the use of the FBM in e-learning contexts
and also platforms based on the model. Muntean (2011) made a theoretical analysis
of gamification in e-learning platforms based on the FBM. Muntean stated that game
elements can be used to motivate and trigger desired behaviors on students and provides
a list of game elements that could be included in an e-learning course. In order to
engage learners with the course, they must be simultaneously motivated, capable and
triggered. With the FBM three elements present, learners will be compelled to execute
a desired action or to perform a desired behavior. Fogg (2009) also includes in his model a social dimension by considering that social acceptance/rejection (related to social cohesion) is an element of motivation along with pleasure/pain (resulting in immediate sensation) and hope/fear (the anticipation of an outcome). The social dimension of acceptance/rejection influences social behavior meaning that people are more motivated to do things with social acceptance and to avoid things with social rejection.

The Academy Platform\(^3\) is a LMS that applies the FBM concepts claiming that for users to complete an e-learning course, they must be motivated, capable and triggered (Growth Engineering, n.d.).

In summary and according to the FBM, a software application aiming to change a users’ behavior \(b\), by making them perform some action, must:

- Give users motivation to do the action \(m\);
- Assuring that they have the ability to perform that action \(a\);
- Give users a trigger that make them perform the action \(t\)

All these three conditions must occur simultaneously, and the model can be expressed by a simple equation:

\[
b = mat
\]

### 6.5 Flow Theory

The Flow Theory was inspired by positive psychology, a perspective originated in the humanistic approach to psychology which began in the 1950 decade. Positive psychology focuses on finding ways to reach an happy life rather than focusing on the pathology of mental illness (Whitson and Consoli, 2009). The theory, was proposed by Csikszentmihalyi (1975) and began as an attempt to explain happiness. Csikszentmihalyi described flow as “the holistic sensation that people feel when they act with total involvement”. When someone is in a flow state “action follows upon action according to an internal logic that seems to need no conscious intervention by the actor”. Flow is also called the optimal experience (Csikszentmihalyi, 1990), or being in “the zone”, as the experience is called by gamers (Chen, 2006). Csikszentmihalyi started to call this experience an “autotelic experience”. Autotelic comes from two greek words, _auto_, meaning self and _telos_, meaning goal (Csikszentmihalyi, 1990). For a matter of simplicity, the term flow was adopted. Another reason was the fact that calling the experience autotelic it was

\(^3\)http://www.growthengineering.co.uk/category/learning-management-system/
assumed that it has no external goals or rewards which is not necessarily so. Csikszentmihalyi also points that a person can experience flow in almost any activity, even activities that are far from being considered enjoyable. In an autotelic experience, the person involved does the activity for its own sake and not because of its consequences or rewards. Csikszentmihalyi began to analyse the effects of the “optimal experience” on artists, athletes, musicians or chess players, considering that they perform high enjoyable and meaningful activities. The theory evolved to consider that almost any person can experience flow in almost any activity, even under stressful or unpleasant conditions. What is meaningful or relevant depends of the individual and of the moment. The quality of the experience depends on subjective challenges and subjective skills (Nakamura and Csiksentmihalyi, 2002).

To summarize the theory, a person must be motivated intrinsically to do the activity and then the person can be kept in a state of flow if there is a balance between the person’s skills and the challenge the person has to face. The challenge/skill balance concept plays a central role in the definition of flow. A model of flow is presented in Figure 6.2. If a person’s skills are low regarding the challenge, than a feeling of worry or anxiety will arise. If the skills are high, then a feeling of boredom or relaxation will be experienced. For a person to be kept in a state of flow, the difficulty of the challenge must increase along with the increase in the person’s skills. An absence of significant challenge and low skills brings the person to a state of apathy.

![Flow Model: Challenge/Skill Balance](image)

**Figure 6.2:** Flow Model: Challenge/Skill Balance (Adapted from Nakamura and Csiksentmihalyi, 2002).
6.5.1 Elements of Flow

Csikszentmihalyi (1975) identified nine major elements (or dimensions) of flow:

- A challenge activity that requires skills;
- The merging of action and awareness;
- Clear goals;
- Direct and unambiguous feedback;
- Concentration on the task at hand;
- The sense of control;
- The loss of self-consciousness;
- The distortion of time;
- Autotelic experience.

Challenges are opportunities for action and skills are the capacities people have to reach desired outcomes (Jackson et al., 2010). In the flow state, there is a balance between challenges and skills. Flow occurs when tasks are within the person’s ability to perform them (Csikszentmihalyi, 1975).

The merging of action and awareness means that a person in a state of flow feels at one with the activity being performed (Jackson et al., 2010). Most of the times, the merging of action and awareness can only be kept for short periods.

Setting correctly and clearly the task goals is a process that allows the person performing the task to be moved towards flow. Knowing clearly what to do keeps the person fully connected with the task (Jackson et al., 2010).

Feedback on how the person is performing a task must be unambiguous and typically immediate. Feedback is an important requirement for both flow and motivation (Murphy et al., 2014). Feedback is the way to inform the person about her or his progress towards the task’s goals.

Concentration on the task means that the person is totally focused on the task being performed (Jackson et al., 2010). There are no external distractions and the person can keep the mind on task with no effort.

When on flow the person feels control over the actions being performed and over the environment (Csikszentmihalyi, 1975). But absolute control means there is no challenge.
and challenge must be experienced to reach flow (Jackson et al., 2010). Therefore, like the balance between challenge and skills, a balance between challenge and control must also exist.

*Loss of self-consciousness* means that the person no longer cares about what others think about her or his performance (Jackson et al., 2010). On performing an important task, people self-evaluate how they are doing and care about the evaluation of others. When a person stops self-evaluation and does not concern about what others think, then the person reached the conditions for an optimal experience.

An altered sense of time or *distortion of time*, also known as the transformation of time, is the sense that time stopped or pass more quickly than expected. The altered perception of time enables a person to be more likely to have an optimal experience (Finneran and Zhang, 2003).

The *autotelic* (doing something for its own sake) nature of the flow experience means that the task needs no external rewards to be performed. Performing the task is rewarding by itself (Csikszentmihalyi, 1975).

### 6.5.2 Flow in Computer Environments

The concept of flow became relevant in game design since Csikszentmihalyi stated that “games are obvious flow activities, and play is the flow experience *par excellence*”. Flow is what a player feels when totally immersed in a video game (Chen, 2006; Raczkowski, 2013). The player loses track of time and becomes unaware of external pressures. Prendergast (2007) points that games, if well designed, are good examples of settings where flow occurs, and also that with DGBL, the challenge is to keep players in a flow state regarding the game and the learning activities. Those activities should not be easy and the player must feel strongly rewarded after success. Therefore, references to flow are also found in the research on gamification, due to its importance in game design. As Raczkowski puts “flow is a ubiquitous concept in gamification discourse”. Also, as Finneran and Zhang (2003) point, the theory has been used to cope with positive user experiences with computers. Regarding instructional games, (Kapp, 2012) also stresses the importance of players to enter in a state of flow.

Concerning the nine elements of flow, some of them are pre-conditions, others are features that must be present during the experience and other are observable immediate consequences of the flow state. During the flow experience some conditions must also be present. These three stages of flow – flow antecedents, flow experience and flow consequences – were pointed by Finneran and Zhang (2003) as a proper framework (See...
Figure 6.3) for empirical flow studies in Computer Mediated Environments (CME) although some debate still exists about what factors should be considered in each stage of flow.

![Flow Framework for Empirical Flow Studies and the PAT model.](image)

According to Finneran and Zhang (2003), in CME, the goal of the activity and the used tool to accomplish the activity must be considered separately. Generically, the activity is composed by the task, which is the main goal of the activity, and by the artefact, the tool for accomplishing the activity. Finneran and Zhang proposed a component-based model for flow antecedents, name PAT model, (standing for Person, Artefact and Task), showed in Figure 6.3. The PAT model highlights the importance of separating the task from the tool. Artefact is a generic term, covering activities with other tools than a CME. Finneran and Zhang also made a distinction between a tool (an artefact used for external sake) and a toy (an artifact used for own sake). Finneran and Zhang remark that when a user is interacting with a toy, the higher the odds to experience flow. Hence, if the artifact is perceived by the users as a toy then they will be more likely to experience flow. This statement is particularly important regarding the use of a CME.

In the PAT model, the interaction between the three components (person, task and artefact) results in a list of flow antecedents (See also Figure 6.4):

- Task-artefact interaction
  - **Task-artefact fit**: a match between the capabilities of the technology and the demands of the task.
• Person-task interaction
  
  – **Clear goals**: the person perceives clearly the task;
  – **Challenge/skill balance**: the person’s skills are adequate to the task’s challenges;
  – **Sense of control**: the person feels control in completing the task;
  – **Immediate feedback**: the person receives timely feedback on task.

• Person-artefact interaction
  
  – **Perceived ease of use**: the artifact must be transparent to the user;
  – **Clear artefact goals**: the user knows how to perform a specific action using the artifact;
  – **Sense of control of the artifact**: the user feels in control of the artifact.

---

**Figure 6.4**: Flow Factors in the Flow Framework.

*Finneran and Zhang (2005)* did a examination of several flow studies to conclude that in a CME, the experience of flow lead to an increase in:

• Exploratory behavior;
• Communication;
• Learning;
• Positive affect;
• Computer use.
6.6 Motivation 3.0

Pink (2009) discusses different kinds of motivation as “operating systems” for human behavior. He starts with Motivation 1.0, mainly based on human biological needs for survival. Motivation 2.0 adds rewards and punishments in human being’s environment meaning that extrinsic motivators also influence human behavior. Motivation 3.0, is based on intrinsic motivation stating that humans need to learn, to create, and to improve their environment are also elements for their motivation. Pink’s approach is similar to SDT but in a non-academic perspective, aiming the general public and business audiences. Like SDT, Motivation 3.0 is based on three elements:

- **Autonomy**: the same element of SDT;
- **Mastery**: similar to SDT’s notion of competence;
- **Purpose**: the notion that people seek a cause greater than themselves.

According to Pink, **autonomy** means that people need to feel a sense of control about what they do, when they do it, who they do it with, and how they do it. **Mastery** demands engagement and begins with optimal experiences where the tasks are neither too hard nor too easy, which is the same as the notion of challenge/skill balance in the Flow Theory. **Purpose** is the novelty in relation to SDT. Csikszentmihalyi (cited by Pink, 2009, p. 174) points that “one cannot lead a life that is truly excellent without feeling that one belongs to something greater and more permanent than oneself”. Besides this feeling, purpose is also related to altruism, meaning the act of doing some action for the benefit of others. The element of purpose is, therefore, part of the Flow Theory although not explicitly pointed as a major element.

6.7 Motivation, Games and Gamification

The motivation theories and the discussion around the benefits and caveats of intrinsic and extrinsic motivation were considered since the first gamified applications became public. Several authors addressed these issues and tried to relate them to the concept of gamification. Before the spread of gamification, other authors like Malone (1981), investigated how video games were fun and motivational. Malone also analysed how features from computer games could be used to make learning with computers more interesting. In a more practical standpoint, other authors started to build applied gamification models that integrate those theories. These models are further detailed in the next sections.
From positive psychology it is possible to conclude that games are a powerful tool capable of influencing players’ lives (Martinho et al., 2014). If carefully used in some particular contexts, like education, than can be very useful. These contributions from positive psychology show what features should be considered when designing games that generate positive effects in education. Those same features can also be used outside games to reach the same goals.

6.7.1 Theory of Intrinsically Motivating Instruction

Malone (1981) made one of the first main contributions to the study of the relation between computer games and learning. He started by reviewing previous theories of intrinsic motivation, including the Flow Theory, and how they were related with learning. His research tried to answer two questions:

- Why are computer games so captivating?
- How can the features that make computer games captivating be used to make learning more interesting and enjoyable?

The research focused particularly on the features of computer games, that, at the time of the research, were only available outside scientific and business computer centers, for no more than three years. In the research, elementary students were interviewed about the computer games that they played. Two games were studied in detail to evaluate sensorimotor skills and cognitive skills. As a result of this research, Malone, proposed a framework for a Theory of Intrinsically Motivating Instruction, based on three categories:

- **Challenge**: this category relates to the notion that a challenging environment must provide goals that are uncertain to reach. The uncertainty can be made possible with variable difficulty game levels (cf. with “players levels” in Section 9.3.4). Other issues like hidden information (cf. with “content unlocking” in Section 9.2.2), multiple level goals (cf. with “game levels” in Section 9.3.4), performance feedback and a score keeping system are also considered in this category. The challenge/skill balance is also pointed as driver for the person’s self-esteem. The distinction between a toy and a tool, concerning computer systems is also addressed in the challenge category. Looking at computer systems as tools, they should be made as easy as possible to use. But if computer system’s users look at them as toys, the difficulty in use increases the challenge leading also to an increase in the pleasure of using the system.
• **Fantasy**: invoking mental images of things not present to a person’s senses or within a person’s experience is what defines a fantasy-inducing environment. Instructional environments with this feature can be more interesting and more educational. Malone made a distinction between extrinsic (the fantasy depends on the skill but the skill is independent from fantasy) and intrinsic fantasies (when the fantasy depends on skill and the skill also depends on fantasy, because it is embedded in the game) where intrinsic motivation has higher cognitive advantages.

• **Curiosity**: curiosity is closely related to challenge and they both depend on feedback to reduce uncertainty. Learning environments should provide an optimal level of informational complexity (neither too complicated neither too simple) to stimulate the learner’s curiosity. Malone argues that curiosity is one of the most important features of intrinsically motivating environments. Regarding this category, feedback should be surprising (by using randomness) and constructive (revealing not what learners are doing wrong to achieve a goal but how to change their knowledge to better achieve the goal).

This framework was proposed in Malone (1981) "as a checklist of heuristics to be used in designing instructional environments" (p. 364). The features of the framework should be present in an intrinsically motivating learning environment. Malone assumes that his theory is not complete because he neglected two important features: learners should choose their activities freely and without external pressures, and interpersonal motivations, like cooperation and competition, should also be taken into account in a complete theory.

### 6.7.2 RAMP

Marczewski (2013a) proposed four key motivational drivers for intrinsic motivation under the acronym RAMP (Relatedness, Autonomy, Mastery and Purpose). He also argues that these drivers can be used as foundations for gamified systems. The RAMP model merges the basic needs from SDT with the three elements of Motivation 3.0:

- **Relatedness** (SDT);
- **Autonomy** (SDT and Motivation 3.0);
- **Mastery** (SDT and Motivation 3.0);
- **Purpose** (Motivation 3.0).
According to Marczewski a gamified system must somehow include one or more of these intrinsic motivators. Regardless of his focus on intrinsic motivation, he also claims that extrinsic motivators can also be part of gamified applications.

Similarly to the RAMP model, Paharia (2013) proposed a set of five intrinsic motivators:

- Autonomy ("I control");
- Mastery ("I improve");
- Purpose ("I make a difference");
- Progress ("I achieve");
- Social interaction ("I connect with others");

Social interaction is the same concept as relatedness in RAMP and SDT. Progress is, in this context, a new motivator, and is defined by Paharia “as the desire to see results in the direction of mastery and the greater purpose” (p. 24), related to mastery and purpose.

### 6.7.3 SAPS

SAPS is an acronym that stands for Status, Access, Power and Stuff. It names a reward structure, to be used in gamification, proposed by Zichermann and Cunningham (2011). SAPS concerns how players value rewards. The SAPS components are ordered in order from the most (Status) meaningful to the least (Stuff) meaningful, from the most engaging to the least engaging and from the cheapest to the most expensive. According to Zichermann and Linder (2013), rewards can be intrinsic (self-generated) or extrinsic (externally delivered). They also state that the goal of a gamified system is to offer rewards that not only act as external incentives but also cope with the intrinsic desires of the users. In the SAPS system of rewards, the components mean:

- **Status**: this component represents the individual position of the player in a social group. It is considered the most meaningful, the most engaging and the cheapest to implement. Game elements related to status are badges and leaderboards.

- **Access**: this second component relates to exclusivity, meaning that the player has an exclusive opportunity to access contents, be able to use some functionalities or any other exclusive event.

- **Power**: the third component is about exercising control over others (e.g. a player is rewarded by being asked to serve as moderator on a forum).
• Stuff: this last component is the least meaningful, least engaging and the most expensive to implement. It means the offering of free things, gift cards or even real money or other tangible rewards.

The SAPS system is criticized by gamification researchers like Deterding (2011) that claims SAPS is a theory with no supporting research, no data to back it up and incomplete. Zichermann and Cunningham targets a business audience and his approach to gamification is from the marketing perspective. Therefore, SAPS system must be seen in a business context. Nevertheless, SAPS can be useful since it categorizes rewards and relates them to intrinsic and extrinsic motivation.

6.7.4 RECIPE

To operationalize his ideas around meaningful gamification, mentioned in Section 5.2.2, Nicholson (2014) uses a set of core elements and created the mnemonic RECIPE where each letter stands for different ways of using game design elements to build meaning:

• Reflection: assisting participants in finding other interests and past experiences that can deepen engagement and learning;

• Exposition: creating stories for participants that are integrated with the real-world setting and allowing them to create their own;

• Choice: developing systems that put the power in the hands of the participants;

• Information: using game design and game display concepts to allow participants to learn more about the real-world context;

• Play: facilitating the freedom to explore and fail within boundaries;

• Engagement: encouraging participants to discover and learn from others interested in the real-world setting.

The RECIPE for meaningful gamification is partially based on the SDT and the RECIPE elements are related to SDT’s autonomy, relatedness and competence (or mastery, as referred by Nicholson). The relation between SDT and RECIPE is shown on Table 6.1.

6.8 Summary

To be motivated means to be moved to do something (Malone, 1980) and several psychology theories try to explain how to get people to do things. In the studies concerning
gamification the most cited theories are the Self-Determination Theory, the similar notions of Autonomy, Mastery and Purpose from Motivation 3.0, and the Theory of Flow. The Fogg’s Behavior Model is a framework to understand what drives human behavior. More close to a practical view of the concept of gamification, other frameworks can be found, like SAPS, concerning how players value rewards, RECIPE, related to the deeper approach known meaningful gamification or RAMP, that merges the motivators from other theories, like the Self-Determination Theory and Motivation 3.0.

All these approaches concerning peoples’ motivation try to understand what motivates people to act, how peoples’ behaviors can be changed, why people enjoy doing some things and do not like to do other things, how to keep people motivated and engaged in an activity and what are the right incentives to keep them engaged.

Building upon these motivation theories, some gamification practitioners proposed approaches like RAMP and SAPS to help gamified application designers to build effective systems. Regarding education, the Theory of Intrinsically Motivating Instruction looked to what video games can bring to learning and teaching. Malone (1981) with his Theory of Intrinsically Motivating Instruction showed the importance of challenge, fantasy and curiosity. Challenge and curiosity categories are closely connected and they depend on feedback. Challenge in Malone’s view is similar in many aspects to the Theory of Flow. Although he argues that Csikszentmihaly does not mention curiosity, an important motivator in learning, he also considers that none of the concepts should subsume the other (Malone, 1980), therefore both concepts can be related to flow. Malone also pointed that his theory lacks two important features that could be related to autonomy (learners should be able to freely choose their activities) and relatedness (a complete theory should consider interpersonal motivations like cooperation and competition).

The contributions from psychology presented in this chapter, along with some more pragmatic approaches also described, state some main guidelines to the design of gamified systems:

- Game elements as drivers for behavior change;
- The role of game elements for extrinsic and intrinsic motivation;
- Autonomy, mastery, relatedness and purpose as pillars of intrinsic motivation;

<table>
<thead>
<tr>
<th>SDT</th>
<th>RECIPE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autonomy</td>
<td>Exposition, Choice and Play</td>
</tr>
<tr>
<td>Competence</td>
<td>Reflection and Information</td>
</tr>
<tr>
<td>Relatedness</td>
<td>Engagement and Reflection</td>
</tr>
</tbody>
</table>
• The way that intrinsic motivation can contribute to the flow experience;

• The importance and the consequences of the flow experience to engagement and learning;

• Flow in a CME, where not only the person and the task are considered but also the artifact (e.g. a software system) as a mediator between the person and the task.

To create effective gamified systems, designers of those systems must not only think about changing behavior by just acting on the players’ extrinsic motivation. They should focus on how to create meaningful experiences, provide a sense of relatedness among players, improve their social recognition, and give autonomy and purpose to their actions. If these conditions are met, gamified systems users will be more likely to experience flow and benefit from the flow consequences.
Chapter 7

Research on Gamification

This chapter provides a synthesis of previous research on gamification. It highlights that the research around this concept concerns different subjects and different scientific areas. These areas are not just related to technology and game design but also related to psychology and digital marketing. The chapter first presents a general overview of some of the known research around gamification. Then it particularizes the research around the gamification of education where some results are already available. These results lead to the first conclusions about the use of the concept in learning settings and are shown in a literature review at the end of the chapter.

7.1 Research Issues

As seen in Chapter 5, gamification is a new concept and reveals a new trend that is being adopted in several different fields of application (Section 5.3). It involves different areas of expertise and research. That can be seen by the numerous definitions of the concept, some of which were presented in Section 5.1.2. This section reveals multiple perspectives, trends and backgrounds from the community of different professionals and researchers that are involved with the concept.

The first approaches to the use of the concept emerged from digital marketing as an answer to the need of increasing users’ loyalty and involvement with the digital presence of a brand or with an online store. Using games in digital marketing was not unfamiliar since advergames (a mix of the words “advertise” e “video game”), a kind of games to convey advertising content, were used for some time. Since this approach deals with users’ behaviors, psychology theories and other approaches related to human behavior were brought to the research around gamification, particularly the ones that already had
been associated with the use of ICT (see Chapter 3). A major concern is how to relate the elements found in games to the behaviors that gamified applications can change or improve. Behavioral psychology issues play an important role in finding the proper strategies to deploy gamified applications, as it was seen in Chapter 6.

The different approaches to the use of ICT in education and the impact of the Web 2.0 in education and particularly in e-learning systems must be considered in any research concerning the use of gamification in education and training where learners are mainly digital natives. The spreading of Web 2.0 applications brought a new type of games, the social games (Section 4.1.5). Social applications and social games can contribute with a new layer, adding further value to the technologies that are already being used in education.

Hence, digital marketing, psychology theories, different e-learning approaches and pedagogical theories, the digital natives debate, GBL, game design and game development issues, are all different disciplines that must be considered in any research concerning the use of gamification in education. Generically, for all domains of application, behavioral psychology plays an important role. As Duggan and Shoup (2013) put, “one way to think of gamification is as the intersection of psychology and technology”.

7.2 General Research on Gamification

A collection of over 60 scientific papers, studies, reports and thesis on gamification and related fields is available at the Enterprise Gamification Wiki\(^1\) of the Enterprise Gamification Consultancy, a gamification consultancy for businesses. Many other papers on gamification have been published since 2010.

A survey conducted by Seaborn and Fels (2015) indicates that the main fields in gamification research are education (26%), health and wellness (13%), online communities and social networks (13%), crowdsourcing (13%) and sustainability (10%).

Hamari et al. (2014) conducted a study in which they analysed peer-reviewed empirical studies on gamification. They noted that since 2011, the term gamification increased the number of mentions in academic paper titles. Hamari et al. browsed several academic databases and selected 24 peer-reviewed empirical research papers for their study. Most of these papers were focused on a generic research question like “does gamification work?”. They concluded that for a majority of the considered papers, gamification does produce positive effects and benefits but is deeply dependent on the context as well as

\(^1\)http://www.enterprise-gamification.com/mediawiki/index.php
on the target users. Also, some studies showed that gamification outcomes may not be long-term and be due to a novelty effect.

Thiebes et al. (2014) conducted a systematic literature review looking for an answer to the following research question: “how can Gamification be applied to IS [Information Systems] to increase end-user motivation?”. Thiebes et al. considered 29 relevant papers with focus on workplace studies. These authors concluded that gamification requires meaningful designs in order to be successfully integrated into an IS. Gamification should make tasks enjoyable for the employees and improve their intrinsic motivation towards the tasks. To Thiebes et al., gamification is an innovative approach that can foster the end-user motivation to utilise information systems. Schlagenhaufer and Ambert (2014) also pointed that gamification in IS is gaining an increasing scientific notice with a growing number of publications.

### 7.3 Research on Gamification of Education

One of the first major contributions to the research about the use of video games in education was made by James Paul Gee (Gee, 2005, 2007). The serious games movement also brought new insights for the use of games in education (e.g. Ulicsak and Wright, 2010). A paper from Lee and Hammer (2011) revealed that gamification was an opportunity to help schools face problems around student motivation and engagement. Karl Kapp’s two books, *The Gamification of Learning and Instruction: Game-based Methods and Strategies for Training and Education* (Kapp, 2012) and *The Gamification of Learning and Instruction Fieldbook: Ideas into Practice* (Kapp et al., 2014) took a deep look to the problem of how to gamify learning and instruction settings. More recently, Farber (2015) launched a field guide (*Gamify your Classroom*) on how to implement gamification in teaching. His book shows the results from a survey of best practices from several interviews with gamification’s experts.

There are already several examples of how gamification and games can be applied in educational contexts. Most of those experiences took place in higher education (Dicheva et al., 2015). There are far less empirical studies reported with younger students. The results from the known experiences show that gamification can have a positive affect on students but for some of the authors involved in those experiences more research is needed (Barata et al., 2013; Brewer et al., 2013; Li et al., 2013; Santos et al., 2013a).

Borges et al. (2014) claimed to have conducted the first systematic mapping research covering gamification of education. Their findings showed that the majority of the research concern higher education (46.2%) and only two studies concern elementary education.
Borges et al. analysed 357 papers on gamification (from 2011 until February 2013) and found 26 academic papers concerning education, mainly conference papers. The majority of the papers researched issues related to behavioral change, student’s engagement, mastering skills and socialization. Only eight of the selected papers included empirical studies.

Regarding Hamari (2013) research, mentioned on the previous section, education and learning was the most common context found. The studies on those contexts considered the learning outcomes of gamification as mostly positive. Increased motivation, engagement in the learning tasks and enjoyment were some of the outcomes of the gamified experiences analysed. But these studies also pointed to negative outcomes such as the effects of increased competition, task evaluation difficulties and design features. Also, user qualities seemed to have an effect on attitudes towards gamification revealing a dependency of gamified experiences from the environments and the types of users.

Next section presents an overview of some of the known research around gamification of education where some results are already available leading to the first conclusions about the use of the concept in learning settings.

### 7.4 Empirical Studies on Gamification of Education

There are several experiments and empirical published studies concerning the use of gamification in technology-enhanced learning settings, using LMSs, PLEs and SLEs. Most of the reported experiences in this section used one of these settings.

Domínguez et al. (2013) presented an experiment in an university course using a gamified LMS (Blackboard) with several game elements like trophies, leaderboards or challenges. They concluded that reward systems and competitive social mechanisms were motivating for students.

Barata et al. (2013) conducted a five years long study in an university course with gamified versions and non-gamified versions of the course, both supported by the LMS Moodle. The gamified version had game elements like points, progress levels, a leaderboard, challenges, and badges. Concerning this version, they concluded that students increased their participation and revealed a deeper engagement. Students also seemed to score better in the gamified version.

Fitz-Walter et al. (2013) conducted an experiment using a gamified, smartphone application aiming introducing new students to an university campus, services and people.
The results suggested that the used gamification elements (clear goals and achievements) add value to the application, encouraging some students to explore the campus more.

Still in the higher education context, Li et al. (2013) showed that with the addition of gamification features in an SLE (PeerSpace), students responded positively to the game mechanics and became more active in social activities.

Hakulinen et al. (2013) used achievement badges in a computer science course, supported by an online learning environment (TRAKLA2) and concluded that the used game component seemed to improve students’ motivation encouraging desired study practices.

Santos et al. (2013a) described an experience of integrating a badging system in a PLE. They conducted the experience with a group of students aged from 13 to 15 years old. The experience revealed that badges in collaborative learning platforms could be useful in the promotion of users’ engagement and motivation.

Barata et al. (2013) conducted an experiment in an university course, with a gamified version and a traditional version. The gamified version had game elements like points, progress levels, a leaderboard, challenges, and badges. They concluded that students increased their participation and revealed a deeper engagement. Students got better results with the gamified version.

Also about the use of badges, Denny (2013) conducted an experiment that introduced this game element in a social learning tool (PeerWyse). Denny discovered a highly significant positive effect on the quantity of students’ contributions. This effect did not reduce the quality of the contributions and Denny claims that students enjoyed being able to earn badges.

Targeting an even younger audience (children from 5 to 7 years old), Brewer et al. (2013) used gamification to motivate and better engage children in laboratory studies. They observed an increase in task completion rates with the use of points and prizes.

Another classroom experiment, with children aged about 7 to 8 years was presented by Kickmeier-Rust et al. (2014). These authors developed a tool for learning and practicing the multiplication table with a set of gamification features. They investigate the effects of gamification and of different levels of feedback to conclude that their approach lead to an increase in motivation and engagement and improved learning performance.

Master and doctoral thesis concerning the gamification of education also arose. An example is Chevtchenko’s (2013) master thesis, which main contribution was the design of an experiment that can be used to evaluate the relationship between motivation and academic performance in contexts using game elements. The proposed experiment targets elementary school students, aged 7 to 8 years. Saeter and Valle (2013) analysed
if the use of game elements could improve the results in processes of reflective learning. They used as a case study an existing mobile application aiming to enhance the users’ reflection by letting them capture experiences and organize them in a timeline. They concluded that gamification could be a useful tool in the field of reflective learning. Although the used gamified mobile application was not strictly aiming educational contexts, the experiment used a test scenario involving a student developing a software project. Fitz-Walter’s (2015) doctoral thesis contributed with a framework for designing gamification applied in an experiment in an university context.

Dicheva et al. (2015) conducted a systematic mapping study covering existing empirical work in gamification in education. The study considered 34 articles and conference papers published from 2011 and until the first semester of 2014. Most of the publications occurred in 2013 (19) end 2014 (12). The study reached the following conclusions:

- The gamification approach was mostly applied to blended learning courses;
- Only two papers considered K-12 education. The remaining publications concern higher education and training;
- Computer Science and ICT educators are the early adopters of gamification;
- There is a scarce empirical research on the effectiveness of gamification in learning environments;
- The authors of the reviewed papers share the opinion that gamification has the potential to improve learning.

### 7.5 Summary

The literature review presented in this chapter revealed that, although several articles and conference papers have been published since 2010, there is still a lack of empirical research on the use and the benefits of gamification. This happens not also in education but also in the other fields of application of the gamification approach. Nevertheless, according to Hamari et al. (2014), education is the most common context found in research. Regarding gamification for the K-12 education, more empirical research is needed. Another important conclusion is that gamification does produce positive effects and benefits and gamification of education, in particular, has a potential positive impact on learning.

---

2Reflective learning can be defined as “those intellectual and affective activities in which individuals engage to explore their experiences in order to lead to new understandings and appreciations” (Bould et al. cited by Saeter and Valle, 2013)
Part III

A Gamification Framework
Chapter 8

Clarification of Concepts

This chapter starts with a general definition for gamification, discussing what the concept is and what should not be confused with gamification. Regarding that education and training are some of the main candidate fields to apply the concept, a more specialized definition concerning education and training, is also provided, along with a definition for social gamification. The chapter clarifies some key concepts included in the general definition. It also provides a detailed explanation of the meaning of all the terms used in the thesis statement. The chapter also explains what is understood as a gamified system and discusses some approaches used by gamified applications to monitor and collect gamification data. Since this thesis concerns the proposal of a gamification framework, a clarification about gamification frameworks concludes the chapter.

8.1 Introduction

In empirical research, defining the precise meaning of terms is a crucial part of the research process (Easterbrook et al., 2008). Along with a definition for gamification, presented in the following section, the terms used in the definition need a further explanation. After presenting the thesis contributions and stating the thesis statement in Chapter 2, several terms must be explained. Therefore, it is mandatory to clarify what is meant by:

- Game design elements;
- Game techniques;
- Game-like engagement;
- Players;
• Target behaviors;
• Gamified systems;
• Gamification framework.

8.2 What is Gamification, After All?

After all the considerations about the concept of gamification, made in this thesis (on Chapter 5), and in spite of several definitions that were presented (Section 5.1.2 and 5.3.6), what is gamification? As it was seen, the most common and accepted definition for gamification is the one proposed by Deterding et al. (2011): “the use of game design elements in non-game contexts”. This is a straightforward definition but it lacks the purpose of the concept and raises some questions. What are game design elements? What is the point of using game design elements in non-game contexts? How should they be used? The main goal is that, by moving game elements to other contexts, it will be possible to induce, on people acting on those contexts, the same engagement that players feel when they play a game. If people are deeply motivated and engaged with some task they are performing, it will be more likely that they exhibit the right behaviors concerning the completion of that task. According to Mora (2013b) the purpose of gamification is “to isolate the basic elements of the games (those which provide their success), to use them in the design of new experiences outside the games”. Gamification has as final objective the improvement of users’ involvement. As also pointed out by Kumar and Herger (2013), gamification is about motivating users.

In this thesis, a more complete definition for gamification will be used, highlighting the purpose of using game elements outside game environments (i.e. providing a game-like engagement in non-game environments) and the final goal of the whole process (i.e. promoting some desired behaviors). Therefore, the definition for the concept of gamification, adopted for the purposes of this thesis, is

The use of game elements and game techniques in non-game contexts, to drive game-like engagement in order to promote desired target behaviors.

This definition highlights the vision of the concept used in this thesis and is related to what Nicholson (2012b) calls meaningful gamification (Section 5.2.2). With meaningful gamification, people engage in an activity because they are intrinsically motivated to perform the activity.
The concept of **implicit gamification**, proposed by Chou (2013) and described in Section 5.2.3, is, in fact, what is considered to be gamification under the above definition.

The proposed definition is also closer to what Kapp et al. (2014) call “**structural gamification**” (Section 5.2.4) rather than their notion of “content gamification”. In Kapp et al.’s view, “content gamification” is closer to serious games and simulations, since it aims to make contents more game-like. “Structural gamification” is similar to the view of gamification used in this thesis in the sense that gamification is the application of game elements with no alteration or changes to the contents of the gamified activities (in Kapp et al.’s definition “contents” mean “learning contents”).

Marczewski’s (2013c) notion of **intrinsic gamification** or “Long Term Deep Level Gamification” (Section 5.2.5) is also what is understood as gamification in this thesis.

**Behavior change gamification** (Section 5.2.6), proposed by Werbach and Hunter (2012), seeks to form new habits among a target population and is also emphasized in the last part of the definition – *to promote desired behaviors*. Werbach and Hunter point that this category of gamification includes “redesigning the classroom to make kids learn more while actually enjoying school”.

Therefore, within this thesis, the concept of gamification is understood as:

- **Meaningful**, as stated by Nicholson (2012b);
- **Implicit**, as proposed by Chou (2013);
- **Structural**, as defined by Kapp et al. (2014);
- **Intrinsic**, as proposed by Marczewski (2013c);
- **Behavior change**, a category proposed by Werbach and Hunter (2012).

As learning scenarios are good candidates for the application of gamification (Section 5.4), **gamification of education** is understood as

> The use of game elements and game techniques in technology-enhanced learning environments in order to improve students’ motivation and engagement.

The more specialized notion of **social gamification** was used in the research questions and in the thesis statement (Section 2.3). Although a definition for social gamification was provided in Section 2.3, the following definition is adopted (differences from the above and more generic definition are emphasized):
The use of game design elements from social games in non-game contexts, to drive game like engagement and social interactions, in order to promote desired target behaviors.

Since many of the underlying features of gamification are not new, why did the concept only gain notoriety so recently? The spread of gamification was only possible when the digital games industry has matured and after a generation of gamers was fully active in their working lives. Video games and online games, like some popular MMORPG, available in platforms such as smartphones, tablets and SNS leveraged the games’ industry to the mainstream surpassing other entertainment industries and causing an impact in the culture of today’s society. The proliferation of digital media and Web 2.0 have also created the environment that helped the dissemination of a concept that, despite all the criticism, became known as gamification.

8.3 What Gamification is Not

Paharia (2013), about the differences between games and gamification, argues that “gamification is not about creating games at all” and Kapp et al. (2014), refer that “gamification uses parts of games but is not a game” (p. 69). Also Huang and Soman (2013) point that “if it is already a game, it is not a form of gamification” (p. 15). Hence, gamification is not a game (Wu, 2011) neither an attempt to simply make an application look like a game (Kumar and Herger, 2013) and also not about building full-fledged games, like serious games (Deterding et al., 2011; Werbach and Hunter, 2012). Serious games (a kind of games described in Section 4.2.1), are not the same as gamification (Schlagenhaufer and Ambert, 2014).

Similarly, gamification of education is not the same as DGBL, an approach discussed in Section 4.2. DGBL consists in using actual games (serious games, COTS games or games made by students, as it was discussed in Section 4.2) in a learning environment. It is not also the same as simulations, although all of these terms are related. Kapp et al. (2014) use the notion of Interactive Learning Event (ILE) to describe these different approaches: games, gamification and simulations. In Kapp et al. perspective, gamification is a type of an ILE and different from the other two types.

Therefore, gamification should not be confused with a process of transformation of some non-game activity into a game. Particularly, regarding education, the application of the concept does not mean that the contents of the various subjects are taught in the form of a game.
Chapter 8. Clarification of Concepts

8.4 What are Game Elements?

As it was seen in Section 5.1.2, several researchers and developers proposed different definitions for gamification. A central component in most of those definitions, including the one from Deterding et al. (2011) and the definition proposed in this thesis (Section 8.2), is the notion of *game elements* or *game mechanics*.

In the literature review for this thesis, it was found an unclear distinction between the concepts of *game mechanics* and *game elements*, like in Huang and Soman (2013) view that refer “... game-like elements, also called game mechanics ...” (p. 13). Most of the times, *mechanics* refers to what is considered as *elements* in this thesis and for other sources they are a mixture of both. For example, Manrique (2013) proposed a list of 35 mechanics, the wiki on gamification.org\(^1\) shows another list with 24 mechanics and Paharia (2013) identified 10 gamification mechanics. These lists include items that are considered as *elements* and items that will be considered as *techniques* (See Section 8.5) in this thesis. The items in these lists came from the observation of actual video games, finding the components that are present in most of them.

To emphasize the lack of agreement in the classification of game elements, Dicheva et al. (2015) showed that a widely used game element – the badge – is classified by different authors as a *game interface design pattern* (Deterding et al., 2011), a *game mechanic* (Zichermann and Cunningham, 2011), a *game dynamic* (Iosup and Epema cited by Dicheva et al., 2015, p. 3), a *motivational affordance* (Hamari et al., 2014), and a *game component* (Werbach and Hunter, 2012). The study conducted by Dicheva et al. concluded that there is not a commonly agreed classification of game design elements. Other terms are also found, like *gameplay mechanics*\(^2\), *game attributes* (Wu, 2011), or *game metaphors* (Marczewski, 2012). The most common term is *game mechanics*. These *game mechanics* are often listed without taking into account that there are elements with very different characteristics, purposes and roles within the game. Most of the times, *game mechanics* usually appear related to interface design patterns, like badges, trophies or leaderboards.

In industry, digital marketing practitioners, place greater emphasis on the use of the terms *game mechanics* and *game dynamics*, often making little distinction between them. Some references (Bunchball, 2010) mention that *game mechanics* and *game dynamics* are confusing terms usually used interchangeably. The mechanics are indicated as the rules and rewards that allow players to play the game and intending to cause certain emotions in them (Table 8.1). The dynamics represent the motivations and desires that

---

lead to such emotions. Players are motivated by game mechanics due to the presence of game dynamics. Zichermann and Cunningham (2011) also define *game dynamics* as “the player’s interactions with the game mechanics”. Most of these definitions are unclear.

**Table 8.1: Game Mechanics and Game Dynamics from Bunchball**

<table>
<thead>
<tr>
<th>Game Mechanics</th>
<th>Game Dynamics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Points</td>
<td>Reward</td>
</tr>
<tr>
<td>Levels</td>
<td>Status</td>
</tr>
<tr>
<td>Trophies, badges, achievements</td>
<td>Achievement</td>
</tr>
<tr>
<td>Virtual goods</td>
<td>Self expression</td>
</tr>
<tr>
<td>Leaderboards</td>
<td>Competition</td>
</tr>
<tr>
<td>Virtual gifts</td>
<td>Altruism</td>
</tr>
</tbody>
</table>

Approaches from the academia and from authors who position themselves as game designers and game developers, try to be more rigorous, applying terms like *game elements*, *game mechanics* and *game dynamics* distinctively but not always with the same meanings. According to Dormans (2012) “when the game design community talks about game systems, they prefer the term ‘game mechanics’ over ‘game rules’. ‘Game mechanics’ is often used as a synonym for rules but the term implies more accuracy and is usually closer to an implementation” (p. 6). Still concerning game design, the MDA games framework proposed by Hunicke et al. (2004) and detailed in Section 4.1.4, considers mechanics and dynamics as design elements.

Within the gamification community of researchers and practitioners, Codish and Ravid (2014) mention that “game elements are also referred to as game mechanics and dynamics” (p. 36) and Werbach and Hunter (2012) consider dynamics and mechanics as categories of game elements. For Deterding et al. (2011), game design elements are all the elements that are characteristic of games or that can be found in most of the games. Deterding et al. proposed a taxonomy for game design elements by different levels of abstraction (ordered from concrete to abstract): *game interface design patterns* (e.g. badges, leaderboards, levels); *game design patterns and mechanics* (e.g. time constraints, limited resources); *game design principles and heuristics* (e.g. clear goals, enduring play); *game models* (concerning models of the components of games); and *game design methods* (concerning game design-specific processes).

### 8.4.1 Adopted Terms and Their Interpretation

From the previous considerations, one conclusion is that *game elements* and *game mechanics* are often referred as being the same thing or as *game mechanics* being a sub-category of *game elements*. In digital marketing, *elements* and *mechanics* are synonyms but for some game designers *mechanics* is a synonym for *rules*. Another conclusion is
Chapter 8. Clarification of Concepts

about the mechanics and dynamics of games. The distinction is unclear and is hard to identify what is considered as game mechanics and what is considered as game dynamics. Mechanics seems to be close to the concept of rules and dynamics is often related to the players emotions. Most of the times, the only way to understand what exactly each author’s adopted terms mean is by the given examples. For the purposes of this thesis, elements, rules (or mechanics) and dynamics are considered to be different. Therefore, the following terms will be adopted, with the corresponding meaning:

- **Game elements**: game design elements or simply game elements are the set of game components that are found in several different kinds of games. They are common to most games and players easily relate them to games. These elements are normally visual components that the players are aware of when they play and correspond to the game interface design patterns from Deterding et al. (2011). Examples of game elements are point systems, badges, levels or leaderboards. These examples are what Nicholson (2012a) calls BLAP gamification and Werbach and Hunter (2012) refer as the PBL triad.

- **Rules**: rules are considered the same as game mechanics and will be understood as how game elements are used. Although game mechanics would probably be a better choice, the term rules is adopted to avoid any possible misunderstanding with game elements since in most of the gamification literature, elements and mechanics are used interchangeably. The notion of rules used in this thesis is closer to the mechanics game component from the MDA framework and also to the concept with the same name in the work of Dormans (2012). Rules govern how the game elements work, how they interact and how they implement the game techniques (see Section 8.5). This is the same view as Kapp et al. (2014), for whom rules are what make gamification elements to work with every element being governed by a rule.

- **Game dynamics**: Dynamics are the emotions caused on players by the gamified environment. Dynamics determine the individual’s reactions as a response to using the implemented rules and techniques (see Section 8.5) applied to game elements. Status, self-expression, competition and altruism are examples of game dynamics (Table 8.1). The game dynamics are the game’s outcomes concerning the emotions felt by the players.

From this point on, the above terms will be used with the indicated meanings, although along this thesis, some of the cited authors may have used originally different terms for the underlying concepts.
Since gamification aims to create a game-like engagement in non-game activities, it must also create meaning, as Nicholson (2012b) proposes with his concept of meaningful gamification. Within this thesis it is considered that this is accomplished not just by adding game elements but by the way they are used, applying the proper techniques. Understanding gamification just as a process of adding game elements, mostly some kind of rewards, to non-game contexts, is a very restrictive view of the concept. It is also far from of what is possible to do with a game-like environment. Game elements, used as rewards, act only on the players extrinsic motivation. They are useful to reinforce desired behaviors and to condition the undesired ones. Rewards can also work well for unpleasant or boring tasks. Although, the use of some game elements, commonly linked to extrinsic motivation, is considered to have a negative impact in intrinsic motivation. But, as Mekler et al. (See Section 6.2) showed, there is no actual empirical evidence to support such claim. Hence, in this thesis, game elements are seen not only as a kind of rewards, improving extrinsic motivation, but also as a way to appeal to players’ intrinsic motivation in favor of creating a meaningful experience.

8.4.2 Which are the Most Used Game Elements?

The task of identifying elements of games is a subjective and heuristic task and still subject to a long debate. The elements of games come in many different levels of abstraction on what a game is (Deterding et al., 2011).

Although there are extensive lists of game elements (as mentioned in Section 8.4.1) proposed by different authors, the most common game elements found in gamified applications are constructs like points, badges, levels, achievements or leaderboards (Mekler et al., 2013), the PBL/BLAP elements. The 10 gamification “mechanics” proposed by Paharia (2013) also include badges, points and levels. These elements act mainly on the players’ extrinsic motivation. But, which of these elements are the most used in already existing gamified applications?

Hamari et al. (2014) analysed several peer-reviewed empirical studies on gamification and found that the most used game elements were precisely points, leaderboards, achievements/badges, levels, and rewards.

Thiebes et al. (2014) conducted a systematic literature review (covering 29 papers) to identify game elements used in gamification applied in Information Systems (IS). The study found that the most used game elements were again achievements, point systems, badges, leaderboards and user levels.
Another study from Seaborn and Fels (2015) surveyed 31 gamified systems (including educational systems) and concluded that the most employed game elements were points (mentioned in 18 papers), badges (15 papers), rewards and leaderboards (both with 11 mentions), challenges (6 papers), achievements, and avatars (both mentioned in 3 papers).

Similar results were obtained by Fitz-Walter (2015) who analysed 32 peer-reviewed articles and concluded that game elements like points, leaderboards, levels and badges were the most popular elements. Virtual currency and avatars were other elements found.

The literature review in Chapter 7 showed in detail which are the game elements that are commonly used in gamified educational environments. This review confirms that points, badges, leaderboards, and levels are also the most used elements in educational contexts. Dicheva et al. (2015) analysed several articles and conference papers guided by the research question “What game elements have been used in gamifying educational systems?”. The study found that the most used game elements were again points, badges, leaderboards, levels, but also virtual goods and avatars (this one mentioned only in one publication).

Also Farber (2015), refers some game elements able to keep learning intrinsically engaging: leaderboards, badges, and avatars.

No significant differences were found in the elements used in general gamified applications and in the elements used in educational contexts. Hence, the most used game elements in gamified systems, mainly according to the studies from Dicheva et al. (2015), Seaborn and Fels (2015), Thiebes et al. (2014) and Hamari et al. (2014), but also considering other studies mentioned in Section 7.4, are:

- Point Systems;
- Badges;
- Leaderboards;
- Levels;
- Virtual goods;
- Avatars.

8.4.3 How Rules Have Been Addressed?

In the literature review, very few mentions were found about how rules are considered in gamified systems. In the analysis of some gamification platforms, the approach found in
some of those platforms was to provide an interface (a dashboard) where the gamification designer was allowed to set up the rules for a gamified activity. An example of this kind of approach is shown in Figure 8.1 from the platform CaptainUp (see Section 5.6). The rule in this example establishes the conditions for a gamified system user win a badge. To win the badge, named as “Breaking the Silence”, the user must make ten comments in one day.

Another approach that was found in the literature review was to use a Domain-Specific Language (DSL). This approach was proposed by Herzig (2014). A DSL is a computer programming language of limited expressiveness focused on a particular domain. Such languages are less expressive than general-purpose languages, but they are suited to express concepts in a target domain. Herzig proposed GaML (Gamification Modeling Language), a DSL to express gamification concepts. Rules are seen as important game constructs because “they define the space, the objects, the actions, the consequences of actions, the constraints, and the goals” (p. 44). Figure 8.2 shows an example of a rule in GaML. To win the badge “Epic”, the user must already have the badge “Icebreaker”, must perform some actions and be at a specific location. This example was taken from Herzig (2014, p. 230).
Chapter 8. Clarification of Concepts

8.5 What are Game Techniques?

Game techniques create the game-like environment that promotes the target behaviors. Game techniques are implemented by game elements and by the way they are used, as defined by rules.

Like game elements, in the literature on gamification, there is no single definition of game techniques neither a common agreement on what they are. The frontier between elements and techniques is many times, unclear. Game elements are the visual elements that the player can see and is aware of. Elements are explicit features in the game environment. Techniques are more subliminal features. As Stokes (2014) puts, they can be seen as the “psychological tricks” used by games to keep players engaged. Techniques are implicit features in the game environment and are what really matters to create a game-like engagement. Game elements, governed by rules, are just the means to reach this end.

The game features classified in this thesis as game techniques are referred by other authors as “gamification design principles” (Dicheva et al., 2015) or “Mechanics & Dynamics” (Thiebes et al., 2014). Like the terms referred in Section 8.4.1 the only way...
to understand what exactly each author’s classification means is by the given examples. The notion of game techniques used in this thesis is related to the elements named as *game design patterns and mechanics* and *game design principles and heuristics* from the taxonomy proposed by Deterding et al. (2011).

Hence, in this thesis, game techniques are seen as the game strategies and heuristics used by game designers to keep players involved with a game, increasing their motivation to keep playing the game. Game elements are the tools to implement game techniques and rules state how game elements work, as a consequence of players’ actions. Game dynamics are the outcomes of a gamified system, the emotions and the players’ reactions to the implemented techniques. Flow, the optimal experience, is the ultimate game dynamic, and can be achieved by a proper implementation of game techniques.

The relations between game techniques, rules, game elements and game techniques can be better illustrated with an example: as it will be seen, content unlocking is a game technique adopted in the framework proposed in this thesis (Section 9.2.2). The technique means that the player can access special content after some achievement. The technique can be implemented with points and levels as game elements. A rule can be set to establish that the player, after completing a game level with a certain amount of points, he or she will be granted access to some special content. With this technique, it is intended (as game dynamics) that the player will get a feeling of achievement (completing the level with a high score) and status improvement (the player gets something that other players do not have). The technique also creates the need for players increase their skills to achieve the needed score. An increase in the challenge implies that players need to increase their skills.

### 8.5.1 Which are the Most Used Game Techniques?

The study from Seaborn and Fels (2015), already mentioned in Section 8.4.2 and the studies from Dicheva et al. (2015) and Thiebes et al. (2014) found that the most employed game techniques are:

- Challenges and goals;
- Progressive disclosure;
- Time pressure;
- Freedom to fail;
- Freedom of choice;
• Social engagement.

At this point it must be emphasized that these studies considered, under the same categories, games’ features that are in this thesis classified differently. Seaborn and Fels (2015) considered in their study features like status (used in five of the studied systems), progression (used in three systems), roles (two systems), narrative (one system), and feedback (one system). Dicheva et al. (2015) mentions status and Thiebes et al. (2014)’s study also considers feedback as a technique. These features are not seen as game techniques in this thesis proposal (see Section 9.2). Feedback is considered as a core concept in the framework (see Section 9.1.7). Status is not a game technique but rather a game dynamic, as seen in Section 8.4.1, or, regarding the SAPS approach (Section 6.7.3), a kind of reward. Status is the position of the player in the social graph (a game element in the proposed framework) and a result of implemented game techniques and rules. Progression is implemented by game elements like levels, intermediate goals or content unlocking. In the Player’s Journey framework (Section 5.5.5), progression means the players’ paths to reach mastery. Hence, progress is more the outcome of several techniques and interactions between game elements than a single technique. Finally, roles and narrative provide context in a game and can also be useful for gamified systems. They are obviously part of most games but not as a game technique as they are considered in this thesis proposal.

8.6 What is a Game-like Engagement?

Werbach and Hunter (2012) argue that gamification is about engagement and a way to design systems that motivate people to do things. Games are highly engaging activities and with gamification, the engagement found in games can be moved to non-game contexts to create the same engaging experiences. These experiences can then motivate behaviors.

To be engaged means to participate or become involved in an activity or to establish a meaningful contact or connection with something. As Pavlas (2010) mentions,

A task is engaging when it continues to produce intrinsic motivation for the task performer. (...) As engagement assists in creating intrinsic motivation, and intrinsic motivation is a key component of flow, the discussion of engagement is particularly meaningful to the understanding flow in games. (p. 47)
Engagement is considered a subset of flow, or flow in a more passive state, without user control (Webster and Ahuja, 2006). For example, a person can be highly engaged watching a movie but cannot control what is happening in the movie. Therefore, it is possible to consider that flow is the same as engagement with the sense of control or autonomy. The sense of control is one of the dimensions of flow, as explained in Section 6.5 and autonomy is one of the three components or psychological needs of intrinsic motivation as stated by the SDT (Section 6.3).

Hence, in the perspective of this thesis, a game-like engagement is the experience of flow (or engagement with user control) in a non-game context, similar to the engagement experienced by video games’ users.

**8.7 Who are the Players?**

Although, as explained before, gamification is not the same as games, the concept is related with the way games work. For the purpose of this thesis, people performing an activity in a non-game context, with game elements added, will be called players. This is not because they are playing a game but because they are considered to be deeply involved in the activity as if they were playing a game.

Issues related to the different types of players that play actual games, should also be considered. Players types (Section 4.1.3) classify players according to their motivations to play. Some players aim competition while others just want to socialize with the other players. Some players seek to beat themselves and others just want to explore every detail in the game. Kim (2011) highlights the importance of the social component, that is, how the players engage with each other during the game. Player types can be linked to game elements. Huang and Soman (2013) classified game elements as self-elements (that get players to compete with themselves and recognize self-achievement) and social elements (aiming interactive competition or cooperation, putting the players in a community where they can share their progress and achievements). These authors emphasize the use of game elements to promote self-achievement, competition and cooperation.

Therefore, players are those whose behaviors are to be changed, the gamified system’s main target users. Players may have an active or a passive role regarding the way their activities are monitored by the system. They are passive players if they have no control over the gamification features of the system and they are active players if they are able to control those features. Some examples of these different roles will be presented in Section 8.9.
8.8 Which are the Target Behaviors?

The overall objective of gamification is to improve players’ engagement and motivation in order to reach a desired target behavior. As Huang and Soman (2013) put “motivation and engagement are usually considered prerequisites for the completion of a task or encouragement of a specific behaviour” (p. 5).

Motivation is a theoretical construction, used to explain behavior. According to the FBM, discussed in Section 6.4, the right amount of motivation is a pre-requisite for a target behavior to occur. Along with motivation, the person’s ability and a trigger are the other factors that must be considered. Game elements can trigger players’ target behaviors (Huang and Soman, 2013).

In educational settings, the target behaviors are the ones usually used as indicators for students’ engagement: class attendance and participation, submission of required work, involvement in the school and in the learning environment, participation in extracurricular activities, etc.

Gamification can provide the triggers for the target behaviors and give the proper amount of motivation. The third factor in the FBM, ability, must be ensured by the learning setting that must be adequate to the students’ skills (the balance skill/challenge, an element of flow).

However, at this stage, it is important to emphasize that, as Huang and Soman states, “one cannot gamify good grades but instead, can gamify the process for students to get good grades” (p. 15). This statement means that the purpose of gamification is not to directly change some outcome but instead change the behavior (the target behavior) that can lead to that outcome. By creating a gamified setting, able to increase motivation and engagement concerning some outcome (the process), players will improve the behavior and, consequently, will have better chances to reach the outcome (good grades). Students with improved skills and better knowledge are more likely to get good grades:

Gamification directly affects engagement and motivation and it indirectly leads to acquiring more knowledge and skills. Gamification encourages students to perform an action; for example, motivating students to practice computer programming will increase their skill and motivating students to memorize consistently can increase their knowledge. (Leong cited by Huang and Soman, 2013, p. 15)
As seen previously, the strengths of gamification concern behavior change. If some behavior, the target behavior, is considered as necessary to reach some outcome, gamification can help reaching the outcome by increasing the levels of motivation and engagement.

8.9 What is a Gamified System?

A gamified system (Figure 8.3) is defined as any non-game context with the addition of game elements and game techniques, governed by a set of rules concerning the way those elements and techniques are used. Players interactions with the gamified system drive game dynamics, the resulting emotions on players. It will be considered that the addition of at least one game element or technique is required. Also, that the purpose of the system is to engage users and influence their behaviors, in order to reach the objectives set for the non-game context. The term system will be used because the gamified setting can be seen as a set of different interdependent components and software programs.

The examples from Section 5.3 show that existing gamified applications deal differently with gamification data. The existing examples show that one or more of four different approaches to monitor and collect gamification data are used. Those approaches are the following:

- **Automatically, by the system itself**: the actions of the players on a website or web application are monitored by the system. The gamified system is the website or web application powered with a generic gamification platform (examples of these platforms were presented in Section 5.6). Alternatively, the gamified application can be build from the start with embedded gamification features. The players are passive players.

- **Using some external device**: a smartphone or another specific device is used to keep track of what the player is doing in a non-digital context. The device synchronizes with a website to upload the collected data. The players take an active part in the process since they can control whether to use the system or not, what to track, what to share or what to achieve. Therefore, players are active players.

- **Relying on the players**: In these systems, the players have full control over the collected data. Data is inserted only by the initiative of the players using an app or logging into a website. The players are active players.

\(^{3}\)A software application running in a mobile device like a smartphone, a tablet computer or other similar device.
• **Relying on a special user**: a human user monitors the players’ activities and is responsible for inserting the data. This user can also be a player with special privileges. The other players are passive players because they cannot act upon what is being monitored.

![Gamified Applications in Digital and Non-digital Contexts](image)

As Deterding et al. (2011) note, “although the overwhelming majority of current examples of ‘gamification’ are digital, the term should not be limited to digital technology” (p. 3). Therefore, non-game contexts can be digital or can be real contexts in the physical world (non-digital contexts). A gamified system can also be a mixture of both.

Regarding the view of a gamified system depicted in Figure 8.3, if the context is digital (left side of the figure), then the gamified system is some software application incorporating those game elements. The system can be a website or a web application. It can run on a server and be accessed by a computer with a web browser or it can be an application running on a smartphone storing data in the cloud. The system can be built as a gamified system from the start, or some piece of gamification software can be added to an existing application. Platforms like the ones that were presented in Section 5.6, provide tools to power websites, blogs and web applications. These tools can be simple
add-ons or plug-ins to monitor and reward the players’ activities. In this approach, users take a passive role (they are passive players in the sense explained in Section 8.7) since they cannot control what is monitored and just let the system monitor their actions.

If the context is non-digital (right side of Figure 8.3), some systems may rely on specific devices or other applications (the mediators) to get the data from the non-digital context. Other systems may need the intervention of a human user (another type of mediator, as shown in Figure 8.3). Players themselves can also act as mediators having an active role within the gamified system (active players). Examples where the players are the mediators are EpicWin, HabitRPG or Lift (see Section 5.3.4), where players set personal goals to improve their habits.

Other examples of gamified systems supporting non-digital contexts can be found. A system like Nike+ (Section 5.3.1), uses a device (a smartphone or other specific device) as a mediator, monitoring players’ (runners) activities. Another similar system is Zamzee (Section 5.3.1).

ClassDojo (Section 5.3.6) is an example of a system in which a special user (the teacher) monitors the players’ (students) activities. Students are passive players and teachers act as mediators. ChoreWars or HighScore House (Section 5.3.4) are also systems where the special user can also be a player.

### 8.10 What is a Gamification Framework?

In this thesis domain, it is possible to find definitions for a gamification framework, like a “set of pre-established procedures that serve to gamify a process” (Mora, 2013a). Such a framework should provide a tested pattern to help the gamification of a process with a better chance of success.

Framework’s definitions are not consensual and vary from author to author. In general, a framework can be considered as a conceptual structure intended to serve as a support or guide for the building of a system. In the ICT context, a framework is often a layered structure indicating what kind of software programs should be built and how they would interrelate in order to produce a software system.

From the software engineering point of view, a framework is a suitable architecture for a system, together with common functionalities (Stevens and Pooley, 2000). It describes how a collection of elements (objects in the software engineering domain) work together. The architecture describes how the system will be built abstracting away from many details. For Mnkandla (2009), a software engineering framework “provides a skeletal
abstraction of a solution to a number of problems that have similarities” (p. 2). The framework also outlines the steps that must be followed in implementing a solution, providing the necessary guidelines of the way the solution should be build.

Hence, a framework comprises an architecture that describes how to build a system, abstracting from implementation details. The architecture can be complemented with other components that help build the system.

For the purpose of this thesis, a gamification framework is understood as

A supporting architecture for a gamified system and a guide on how to use the gamified system.

The aim of the framework is to ease the implementation and use of gamified systems. The architecture shows what a gamified software platform should have, and the guide is intended to help a gamification designer in the development of a gamified activity, supported by the software platform.

8.11 Summary

This chapter provided a general definition for gamification that will be considered in this thesis. This definition was particularized for education and training contexts. The components of the general definition were thoroughly analysed and clarified. The meaning of some key terms like game elements, rules (or game mechanics) and game dynamics was explained. Rules and game mechanics were considered as synonyms. Since game mechanics is confused with game elements in most of the gamification literature, the term rules will be used in this thesis.

Game elements and game techniques are central concepts in the proposed definition of gamification. These two concepts were detailed in this chapter and the most used elements and techniques, found by previous research, were presented and are shown in Table 8.2. This table shows only the elements and techniques considered as such in this thesis.

Rules govern how the techniques are applied and how the elements relate to each other to implement the techniques. Dynamics are the gamified system’s outcomes, resulting from the players interactions with the system.

What should be understood as game-like engagement was also explained. Gamification is about behavior change. The users’ behaviors addressed by the gamified system are
referred as the target behaviors. A definition for a gamified system was also provided, and the different ways that existing gamified system deal with gamification data were described. For the purposes if this thesis, the users of a gamified system will be called players. Finally, what is understood as a gamification framework within this thesis research was also explained.
Chapter 9

GET7 Components

Prior to the framework's architecture and guide definitions, detailed in the following chapters, this chapter presents the foundations of the framework, starting with its core concepts. The core concepts and the set of game elements and game techniques are the framework’s components. The framework aims to keep a small and comprehensive set of game elements with the proper techniques to apply gamification in a meaningful way. The chapter explains the framework’s components in detail along with its relevance to educational contexts.

9.1 Core Concepts

9.1.1 Introduction

The GET7 framework considers game elements not just as extrinsic motivators but as being part of a system capable of providing long term engagement and behavior change. Game elements can be used to reward the players but also to give them feedback for their actions. Proper feedback helps to keep the balance between the players’ skills and the challenge’s difficulty level. The social component of the gamification process, the sense of autonomy and control, along with the concepts of fun and flow are also considered. These are the core concepts that are closely tied to the chosen game elements and game techniques that are part of the framework.

The GET7 framework evolves from this set of core concepts. To address the thesis statement (Section 2.3) the framework must be able to support the development of gamified systems that increase users’ tendency to experience flow, meaning that players must be kept in a flow channel avoiding boredom and anxiety as shown in Figure 9.1, adapted from Csikszentmihalyi (1975).
Therefore, three of the flow antecedents (person-task interaction: clear goals, challenge/skill balance, sense of control, immediate feedback), discussed in Section 6.5.2 were considered to be part of the framework core concepts. The first antecedent, clear goals, will be considered not as a core concept but as a game technique (see Section 9.2.1). Besides the Flow Theory, the core concepts consider also the SDT psychological basic needs (autonomy, competence and relatedness, see Section 6.3) and elements from Motivation 3.0 (mastery and autonomy, see Section 6.6). The notion of meaningful gamification is also considered. This notion is the same found in the RECIPE approach and, as seen in Section 6.7.4, RECIPE is also connected to SDT and Flow. The FBM framework (Section 6.4) also made a contribution with insights about how to use persuasive design to trigger desired behaviors and increase motivation.

Zichermann (2012) identified three recurrent concepts in gamified systems that drive engagement, the 3F: Feedback, Friends and Fun. These terms correspond to concepts from the above theories and are used in the GET7 framework as part of some of the designations chosen for the core concepts.

Hence, the GET7 core concepts are:

- **Challenge/Skill Balance**: an important flow antecedent;
• **Autonomy & Control**: the sense of control is a flow antecedent complemented with autonomy, a basic need from SDT;

• **Feedback & Rewards**: feedback is a flow antecedent and rewards are means to provide feedback;

• **Friends**: to implement the social gamification concept and tied to relatedness, a basic need from SDT;

• **Flow & Fun**: a transversal core concept, complementing the other concepts.

The core concepts are presented and explained in the following sections.

### 9.1.2 Challenge/Skill Balance

The **challenge/skill balance** concept is what keeps the player in the flow channel (see Figure 9.1). For the player to experience flow, the task must be at the same time challenging and achievable. If the task is not challenging, then it becomes boring. But, if the task is too difficult, the player becomes frustrated and anxious. In each case, the player is out of the flow channel and loses interest in the task. The relationship between the challenge and the player’s skills is a prerequisite for flow. The player must be kept in the flow channel. If the player’s skills improve, then the task must become more difficult but not too difficult to drive the player out of the channel. As stated by Chen (2006), “(...) to find exactly the right amount of challenge to engage with the exact abilities is the only way to access Flow” (p. 7). As seen in Section 6.5, the concept of challenge-skill balance is crucial to the definition of flow. This concept is also relevant in learning contexts as shown by the challenge category from the Theory of Intrinsically Motivating Instruction (Section 6.7.1).

### 9.1.3 Autonomy & Control

**Autonomy** is an element of SDT and Motivation 3.0. Along with the sense of control, a flow antecedent, they are part of the core concept named as **Autonomy & Control**.

As a flow antecedent, control means that the person feels control in completing the task (how to do the task). Autonomy is slightly different, meaning that the person also controls what to do, when to do it and with whom.

This core concept also contributes to intrinsic motivation – the autotelic experience, an element of flow. Moodlerooms (2013) offers some highlights about the relevance of autonomy and control in education:
You can greatly motivate some students by offering them a choice of what they can do within the context of your gamified classroom. They have an opportunity to learn the content depending on their skill and interest level. And, by completing certain tasks or quests, students can “level up” to unlock additional content, receive bonuses or special privileges, or even purchase items from the class store using awarded experience points.

### 9.1.4 Feedback & Rewards

Immediate **feedback** is the way to communicate rapidly with the players and let them know the results of their activities. This communication can contribute to maintain a high level of involvement. **Rewards** can be used to deal with extrinsic motivation, but according to Murphy et al. (2014), they can also be used as a form of feedback and, therefore, this core concept is named as **Feedback & Rewards**.

In education, Keeler (2013), points for the importance of immediate feedback:

> The feedback in games is given along the way not necessarily only after a task is completed. Games provide a variety of different types of feedback. Feedback is most valuable if it can be given as soon as possible. Computers can have the ability to let students know after each answer if they are understanding the material. Finding ways to provide feedback to students can help motivate them.

Feedback is one of the 3F drivers for engagement (Zichermann, 2012) and is also an important component in modern learning theories (Murphy et al., 2014).

### 9.1.5 Friends

According to Wojcik (2013), the essence of social games success lies in the possibility to play these games with friends and the ability to compare results with them. In social games, a player can play with friends (collaboration) or against friends (competition). The concept of **friends** relates to this social context, where collaboration, sharing and competition features of social games play an important role, creating a meaningful community. The friends concept takes its name from one of the 3F drivers for engagement proposed by Zichermann (2012). The friends concept is also what is called relatedness in SDT (Section 6.3), a psychological basic need related to the desire to interact and be
involved with others. As relatedness contributes to intrinsic motivation, the friends concept is considered as a core concept in the proposed framework due to its contribution to a meaningful gamification approach.

The social context, represented by the friends core concept, is relevant to increase engagement and motivation. As Hamari (2015) points out, individuals are more likely to engage in behaviors that they perceive others are also engaged in. Observing the activities of others, and acknowledging which behaviors they have been rewarded for, will trigger the right behaviors to perform. Hamari also points to the importance of social validation, by which players signal that they have also engaged in the right behaviors. He also mentions social comparison, the persuasive power that emerges when people compare their achievements with others. Still according to Hamari, gamification provides the means for players to observe the activities of others and, therefore, also the means for social validation and social comparison. According to Hanus and Fox (2015), competition, resulting from social comparison, often makes individuals aware of their lack of skill, status, or position. This negative effect can be avoided with constructive competition that occurs when competition is a fun experience that aims positive interpersonal relationships.

9.1.6 Fun & Flow

Fun is an obvious component of games. It represents the inherent elements of amusement and delight found in games. According to Koster (2005), for a game to be fun it must allow players to gain new skills, to apply those skills towards the game’s goals, and to solve new problems within the game. This notion of fun is what students should experience to engage in deep learning (Shernoff et al., 2014).

Fun is hard to define and means different things to different people. But, as Koster (2005) points out, fun in the context of video games arises out of mastery. For a video game to be fun, it must develop an ability to master the next step in the game. Zichermann and Linder (2013) also mention that mastery and progress are what makes gamified experiences fun. Fun, resulting from mastery and from the sense of control that leads to flow, must also be part of a meaningful gamified application. Fun is the third of the 3F drivers for engagement from Zichermann (2012).

The relationship between fun and flow is pointed by Chen (2006): “fun can be defined as Flow, a balance of the relationship between challenge and ability” (p. 7). Also Murphy et al. (2014) claims that “fun is a critical part of both motivation and flow” (p. 170). Hence, both fun and flow are considered under the same core concept.
Fun and flow are relevant in learning settings. The importance of flow in student engagement was remarked by Shernoff et al. (2003) and Shernoff and Csikszentmihalyi (2009). Koster (2005) mentions the relation between fun and learning, stating that “fun is really just another word for learning” (p. 47). For Prensky (2007), the role of fun in the learning process is to create relaxation and motivation, enabling learners to be more willing to learn.

### 9.1.7 Core Concepts Relationships in GET7

The balance between challenge and skill, the sense of control, and immediate feedback are the considered antecedents of flow from the PAT model. Friends, understood here as the feeling of relatedness from the SDT, foster intrinsic motivation that leads to an autotelic experience, a component of flow. Hence, the core concepts of **Challenge/Skill Balance, Autonomy & Control, Feedback & Rewards** and **Friends** are all related to **Flow**. They are also related to **fun**. Regarding the 4keys2fun framework (see Section 4.1.4), **Challenge/Skill Balance, Autonomy & Control, Feedback & Rewards** are considered in GET7 as related to the notion of “hard fun”. According to Lazzaro (2004), games with this key to fun give the player a choice of strategies, reward the player with feedback and allow the player to test skills, balancing those skills with the game difficulty. Another key to fun, the “people fun” is clearly related to the core concept of **Friends**. As Lazzaro puts, “players using this key see games as mechanisms for social interaction” (p. 5). Finally, the “serious fun” key can also be considered as the kind of fun that players feel when they are in the flow state. Therefore, the **Fun & Flow** concept is considered in a cross-sectional design of the core concepts’ set and transverse to the other concepts, as shown in Table 9.1.

<table>
<thead>
<tr>
<th>Core Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Flow &amp; Fun</strong></td>
</tr>
<tr>
<td>Challenge/Skill Balance</td>
</tr>
<tr>
<td>Autonomy &amp; Control</td>
</tr>
<tr>
<td>Feedback &amp; Rewards</td>
</tr>
<tr>
<td>Friends</td>
</tr>
</tbody>
</table>

Gamification designers should not primarily design things to be fun, but to be deeply engaging and meaningful. A proper balance between a person’s skills and the challenge they face, an immediate feedback on how they are doing, a sense of control and autonomy about how to achieve the goals, along with the feeling of being connected to others are
what is needed to reach a flow state. If the flow state is reached, the activity will be fun for the person performing it.

In learning contexts, Whitson and Consoli (2009) highlights the importance of flow and stresses the relation between flow and some of the other proposed core concepts:

In summary, the characteristics of flow can be implemented in the classroom. The classroom must be orderly and rules and expectations must be clear. By allowing students an opportunity to participate in choosing what they will learn and how they will learn it [Autonomy & Control] (for example group work), positive emotional bonds can be formed. Through consistent and individualized incremental skill-based assessment (feedback) [Feedback & Rewards], teachers can match required skill to task to assuage anxiety and prevent boredom [Challenge/Skill Balance]. Challenging appropriate tasks, clear expectations, feedback, and emotional memories of success will motivate our students to return to the learning process repeatedly as life-long learners. (p. 46)

### 9.2 Game Techniques

Game techniques aim to keep players in the flow channel. In GET7, game techniques are associated with the core concepts identified in the previous section. Game techniques use game elements according to a set of rules (see Section 10.5) that define how the elements are used and what they are used for, concerning the core concepts. The most used game techniques in existing gamified systems were identified in Section 8.5.1.

The GET7 framework includes the following 7 game techniques:

- Clear and intermediate goals;
- Content unlocking (or progressive disclosure);
- Time pressure;
- Fun failure (or freedom to fail);
- Multiple paths (or freedom of choice);
- Social interactions (or social engagement);
- Virtual economy.
The first six techniques are the ones mentioned in Section 8.5.1, some of them with different names. A final technique, virtual economy, was added to deal with virtual currencies (a GET7’s game element, see Section 9.3.7). Figure 9.2 shows how the framework’s game techniques are considered regarding the flow theory (cf. Figure 9.1).

The following sections describe the chosen game techniques in detail. The relation of the framework’s core concepts with game techniques are shown in Table 9.2

**Table 9.2: Core Concepts vs. Game Techniques**

<table>
<thead>
<tr>
<th>Core Concepts</th>
<th>Game Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Challenge/Skill Balance</td>
<td>Clear and Intermediate Goals, Content Unlocking, Time Pressure, Fun Failure, Multiple Paths</td>
</tr>
<tr>
<td>Autonomy &amp; Control</td>
<td>Clear and Intermediate Goals, Multiple Paths, Virtual Economy</td>
</tr>
<tr>
<td>Feedback &amp; Rewards</td>
<td>Content Unlocking, Fun Failure, Social Interactions</td>
</tr>
<tr>
<td>Friends</td>
<td>Social Interactions, Virtual Economy</td>
</tr>
</tbody>
</table>
9.2.1 Clear and Intermediate Goals

Defining clear goals for an activity is a prerequisite to experience flow doing the activity. It is a flow antecedent in the PAT model, as discussed in Section 6.5.1. Clear goals are important so that players understand what they have to do to complete an activity when their skills are still low. Thiebes et al. (2014) refer the importance of challenging tasks with clear goals for motivating information systems’ users.

The importance of this game technique for educational settings, and its relation to challenge/skill balance core concept, is pointed by Lee and Hammer (2011): “one critical game design technique is to deliver concrete challenges that are perfectly tailored to the player’s skill level, increasing the difficulty as the player’s skill expands. Specific, moderately difficult, immediate goals are motivating for learners” (p. 3).

Also defining intermediate clear goals by breaking a task into smaller subtasks is important to create a sense of progress as advised by Keeler (2013): “design your units to start with simple tasks that you can recognize and reward students for achieving. Break up units/instruction into smaller tasks that gradually get more difficult”.

In the GET7 framework, initial clear goals are important for players understand what they have to do to complete the task when their skills are still low (Figure 9.2). Intermediate goals help keep players in the flow channel by balancing the players’ skills, as they improve, with the task challenges keeping them engaged with the gamified system (Li et al., 2012). Intermediate goals will be set by using levels, a game element (Section 9.3.4).

The clear and intermediate goals technique is linked to the challenge/skill balance and autonomy & control core concepts (Table 9.2).

9.2.2 Content Unlocking

Content unlocking allows players to access contents within the game that are not open to everyone but the access is gained as a reward for previous actions. The relevance of this technique in education is pointed out by, for example, Moodlerooms (2013). Content unlocking is mentioned by Werbach and Hunter (2012) and is also known as progressive disclosure (Li et al., 2012; Thiebes et al., 2014).

In the GET7 framework, this technique is used to push players to the flow channel assuring the balance between their skills and the activities’ challenges:
Chapter 9. GET7 Components

A game helps players to continuously increase their skills by progressive disclosure of both knowledge and challenge. This will help ensure that the challenges in the game match the player’s skill levels. For example, the system could provide more strict guidance to a novice user or more freedom to proficient learners. (Li et al., 2012, p. 105)

This technique can also be used to avoid players’ boredom by appealing to a desire to explore when players’ skills become high (see Figure 9.2). By revealing new content to reward success and offering new challenging goals helps avoid boredom, leading to an increased motivation.

The content unlocking technique is related to the challenge/skill balance and feedback & rewards core concepts (Table 9.2).

9.2.3 Time Pressure

Time pressure is commonly considered as an important and effective aspect of games. It is a technique that forces players to complete a task within a time limit. Time is used as a scarce resource. As Li et al. (2012) state, “adding time pressure is effective as it establishes clear and challenging goals”. Visually, time pressure can be implemented by using counters or hourglasses (Li et al., 2012). This technique is mentioned by several authors like Reeves and Read (2009) and Thiebes et al. (2014).

In the GET7 framework, time pressure is used to avoid boredom, by challenging players to complete a task within a limited amount of time. Players could feel a sense of boredom if their skills match or overpass the challenge (Figure 9.2). Doing the same task in a lesser time is a way to challenge players and avoid boredom.

The time pressure technique is associated to the challenge/skill balance core concept (Table 9.2).

9.2.4 Fun Failure

In video games, if players are not successful they are allowed to try again, over and over, until they succeed. In a well designed game, they will succeed after a few failures and they can proceed to the next challenge. Players learn about the game everytime they try to overcome a challenge and fail. As they learn, they have better chances to succeed in the next attempts. The risk of failure is low and many times it can even be fun.
The technique named as fun failure, also known as freedom to fail, is the possibility of repetition after failure without any negative consequence but rather making it fun (if possible), inducing in the player a sense of control. Koster (2005) observed that “fun is about learning in a context where there is no pressure, and that is why games matter” (p. 99). “No pressure” means that players are allowed to fail without penalty, and they can try repeatedly until they succeed. Games offer a safe place to fail and, in each try, players can learn something more.

The term fun failure is used by McGonigal (2011) to stress that, in video games, positive failure feedback reinforces the sense of control over the game. She also points to the importance of a goal-oriented environment where a sense of control is a powerful driver for success. The right kind of failure feedback (i.e. making it fun) is a reward that makes players more engaged and with greater chances to do better. Still according to McGonigal, games can eliminate the fear of failure and improve the players’ chances of success.

The relevance of a learning environment where students feel safe to fail and try again is mentioned by many education researchers like Gee, cited by Lee and Hammer (2011, p. 3): “because games involve repeated experimentation, they also involve repeated failure. In fact, for many games, the only way to learn how to play the game is to fail at it repeatedly, learning something each time”. Other sources, like Keeler (2013) and Moodlerooms (2013), also stated the importance of creating in the classroom a culture with a low risk of failure. Others stress its importance as a learning technique: “it lets them [the students] approach knowledge and skills, using the learn-by-failure technique that is popular in game-like environments, without the embarrassment factor that usually forms a part of classroom education” (Leong cited by Huang and Soman, 2013, p. 24).

Fun failure is used in the GET7 framework as a way to make the player reenter the flow channel when the player’s skills do not match the challenge’s difficulty level. Allowing the player to play repeatedly and learning along the way will improve skills moving the player from the anxiety zone to the flow channel (Figure 9.2).

The fun failure technique is linked to the challenge/skill balance and feedback & rewards core concepts (Table 9.2).

### 9.2.5 Multiple Paths

Games provide multiple routes to success, allowing the player to choose different paths to reach the game’s goals (Lee and Hammer, 2011). The multiple paths (or freedom
of choice) technique is the possibility that allows the player to choose one path, from a set of different possibilities, to get to an objective. It relates to the sense of autonomy and to the element of choice from RECIPE (Section 6.7.4). The player is allowed to select different paths and to develop goals within the non-digital context that are more meaningful to the player’s interests. According to Nicholson (2012b), a gamified system should provide players with a variety of activities to choose and not just rely on a linear path to follow. Choice is a key element for meaningful gamification.

In educational settings, students should be allowed to choose their own sub-goals within the larger task and the way to follow those sub-goals. This approach offers students choices in how they achieve the learning objective (Keeler, 2013). It also gives students different ways to express themselves more creatively.

The importance of choice for optimal learning experience, conducive to flow, is emphasized by Whitson and Consoli (2009). Teachers must offer more tasks that invite student’s choice. Although, giving players too many choices can be overwhelming. One way to avoid this is to let players choose a goal, and provide them a guide that they can follow to reach the goal (Nicholson, 2014). Badges and levels (game elements in GET7, see Sections 9.3.2 and 9.3.4) are ways to provide this guidance.

In the GET7 framework, allowing players to choose one of different possible paths is, like fun failure, a way to move players from an anxiety zone to the flow channel. That can happen if player’s skills are below the challenge’s difficulty level. By allowing the player to choose the best way to reach a goal, knowing that failure is not an issue, is a way to decrease anxiety (Figure 9.2). Setting intermediate goals with no fixed order, gives players a sense of control and a feeling of autonomy.

The multiple paths technique is associated to the challenge/skill balance and autonomy & control core concepts (Table 9.2).

### 9.2.6 Social Interactions

Social interactions, as a game technique, relate to game design principles found in casual social games (see Section 4.1.5) usually available in SNS. A SNS can be defined as

Web-based services that allow individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system. (Boyd and Ellison cited by Landers and Callan, 2011, p. 407)
These social interactions found in SNS drive users’ engagement and improve their motivation. Social games take advantage of those interactions. Users can receive feedback for their achievements, like earning a badge. Those achievements can be displayed in the SNS user’s profile, to make it visible to others (the user’s friends within the SNS). By displaying these accomplishments publicly, users can be appraised and get positive feedback from other SNS users, and be motivated to pursue more accomplishments.

The social interactions technique includes what Thiebes et al. (2014) call social influences, that comprise competition and collaboration. Regarding competition, Thiebes et al. and Huang and Soman (2013) refer leaderboards (A GET7 game element, see Section 9.3.3) as the most important game element that can implement competitive social interactions. Regular leaderboard updates promote competition and improve participation. Leaderboards also made performance visible and present to others, demonstrating each player’s capabilities. Competition also contributes to a desire for status and reputation. Collaboration is a kind of social interaction opposite to competition. Collaboration is important to strengthen relationships in teams and can be supported by, for example, virtual gift giving.

Within the GET7 framework, social interactions are connected to the friends core concept and are a way to keep players in the flow channel (Figure 9.2). Regarding educational settings, the social interactions technique intends to motivate students to improve their skills with social rewards and other incentives (Simões et al., 2013b). The recognition of academic achievements by teachers and also by peers helps students to be closely connected to school and to develop a school-based identity. Social recognition and rewards also motivate students to improve their skills. In GET7, social interactions are a way to keep players in the flow channel (Figure 9.2).

The social interactions technique is linked to the feedback & rewards and friends core concepts (Table 9.2).

### 9.2.7 Virtual Economy

A virtual economy, or in-game economy (Farber, 2015) is a feature found in many games. Virtual economies deal with the exchange of virtual goods in some virtual world in the context of a digital game. Virtual goods are digital items that have value within a game (Werbach and Hunter, 2012). The first virtual goods were used in MUD games and later on MMORPG’s. Werbach and Hunter define virtual economy as “a functional market system in a game, typically including virtual currency and virtual goods that are subject at least in part to economic forces”. Within the game, virtual currencies (a game element in GET7, see Section 9.3.7) are a medium of exchange. Virtual currencies
are part of virtual economies that need some kind of currency to operate. Donations and virtual gift given, from one player to another, are also interactions between players that are made within a virtual economy. A virtual economy can also set the rules for the exchange of virtual currencies with physical goods.

Hence, a virtual economy, by setting the rules for the use of virtual currencies and for the trade of virtual and physical goods, increases the players’ senses of autonomy and purpose and allows interactions between players. As seen in Chapter 8, these are some of the ingredients for intrinsic motivation that, in turn, are part of flow experiences. Trading and gifting among players help build a community. Being part of a virtual economy helps to keep players in the flow channel (Figure 9.2).

In the GET7 framework, the virtual economy technique is the way to establish a marketplace, where players can use virtual currencies to purchase virtual or physical goods. It also allows players to use virtual currencies to make donations to other players or to some initiative in the non-game context (e.g. a class or school project or event).

The virtual economy technique is related to the autonomy & control and friends core concepts (Table 9.2).

### 9.3 Game Elements

In the process of identifying the framework’s game elements it was necessary to establish some way to organize them by the role they play and how they will be involved in the gamified activity.

As seen in Section 8.4.2, points, badges, leaderboards and levels are the most used game elements and, for this reason, they are considered in GET7. Progress bars are another popular kind of game elements with special relevance in education. Progress bars will also be considered in the framework. These elements have been used with success in learning settings as many examples presented in Section 5.3 show. Still, regarding the findings presented on Section 5.3, virtual currency is considered in the place of virtual goods. Virtual currency (further explained in Section 9.3.7) is a more general concept that can be used to trade virtual and physical goods. The element named as social graphs is considered in GET7 due to its importance to the framework’s social component. Avatars, although mentioned in the list of most used game elements in Section 8.4.2 are not considered in GET7. Avatars were found in a less number of empirical studies than other game elements.

In summary, the following 7 game elements are part of the GET7 framework:
• Point Systems;
• Badges;
• Leaderboards;
• Levels;
• Progress bars;
• Social graphs;
• Virtual currencies.

Figure 9.3 shows how the framework’s game elements are considered regarding the flow theory (cf. Figures 9.1 and 9.2).

A UML class diagram for game elements is shown in Figure 9.4.

Game elements can depend directly from players’ actions (e.g. a player does something and get some amount of points). They can also depend on other game elements (e.g. a leaderboard that ranks players by their number of points) or they can depend on both (e.g. a player can get a badge directly from some action or the player can get a badge because for having reached the top of a leaderboard). Regarding these possibilities, game elements are considered primary game elements if they depend only on players’
actions and they are considered secondary game elements if they depend on other game elements. Finally, some elements can be primary or secondary, depending on how they are used. Table 9.3 shows how the elements from GET7 framework are classified under this criteria. In Figure 9.4 the association has primary element shows the dependency between primary and secondary game elements.

Table 9.3: Primary and Secondary Game Elements

<table>
<thead>
<tr>
<th>Dependency Type</th>
<th>Game Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>Points, social graph, levels (game levels)</td>
</tr>
<tr>
<td>Secondary</td>
<td>Leaderboards, virtual currency</td>
</tr>
<tr>
<td>Primary and Secondary</td>
<td>Badges, levels (player levels), progress bars</td>
</tr>
</tbody>
</table>

The relation between the chosen game elements and the game techniques are shown in Table 9.4.

The following sections describe the chosen game elements in detail. Before further explanation about game elements, the gamified system’s users must also be detailed. There are two types of users: players and non-players. Players where described in Section 8.7. Non-playing users are the users that act as mediators (see Section 8.9). Another non-playing user is the gamification designer (or designer, for short), the
### Table 9.4: Game Techniques vs. Game Elements

<table>
<thead>
<tr>
<th>Game Techniques</th>
<th>Game Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear and Intermediate Goals</td>
<td>Points, Badges, Levels, Progress Bars</td>
</tr>
<tr>
<td>Content Unlocking</td>
<td>Points, Levels, Virtual Currencies</td>
</tr>
<tr>
<td>Time Pressure</td>
<td>Badges, Levels</td>
</tr>
<tr>
<td>Fun Failure</td>
<td>Points, Badges, Levels</td>
</tr>
<tr>
<td>Multiple Paths</td>
<td>Points, Badges, Levels</td>
</tr>
<tr>
<td>Social Interactions</td>
<td>Leaderboards, Social Graphs</td>
</tr>
<tr>
<td>Virtual Economy</td>
<td>Social Graphs, Virtual Currencies</td>
</tr>
</tbody>
</table>

User responsible for defining the gamified activity. The guide that will be presented in Chapter 11 is to be followed by designers. The designer and the mediator can be the same person.

![UML Class Diagram for Gamified Systems' Users and Mediators](image)

Figure 9.5 shows a UML class diagram were users and mediators in a gamified system are depicted. The class **System** includes possible external devices and generically represents the actions of some part of the system that automatically collects gamification data.
9.3.1 Point Systems

Point systems, or just **Points** for short, are probably the most used and better understood game element and one of the first to be used in non-game contexts. Points exist in most of competitive games, not only in video games but also in board games, card games or sports games. A point system can be seen as numbers attached to each player that can go up and down (Paharia, 2013) and they can be given for an action or for a combination of actions. Points can represent an amount of something that the player has or gains throughout the game and can be “spent” in virtual or physical goods. Points can serve different purposes (e.g. deciding who wins the game or when the player can level up) and may be related to other game elements.

There are different kinds of point systems in games that can also be applied in non-game contexts. Zichermann and Linder (2013) mention five kinds of point systems: XP (eXperience Points tracking the player’s experience); Redeemable (points acting as currency that can be redeemed); Reputation (points used to signal the player’s reputation); Skill (points showing the player’s ability in some area) and **Karma** (points gained for helping others). Zichermann and Linder emphasize the first kind (XP) as a starting approach. Also Wang and Sun (2011) distinguish a score system from a XP system. The first is based on the player’s performance and skill and the second reflects time and effort.

In this proposal, three kinds of point systems will be considered, shown in Figure 9.6 as UML classes:

- **Action Points** (AP), that can be gained by the players for the execution of a specific task or that can be used to give feedback on behaviors (e.g. positive points to reward desired behaviors and negative points to punish the undesired ones). Action Points are awarded by a special player or user (the mediator, see Figure 8.3) or set by this special player or user. They are used to measure progress in the non-game context and reflect players’ performance. AP reward single actions or behaviors.

- **Social Interaction Points** or just **Social Points** (SP): points gained by social interactions like helping others, commenting or liking activities of other players, sharing with the community, receiving appraisal from other players, etc. This kind of points is related with Zichermann and Linder’s reputation and karma points. SP are awarded automatically by the gamified application and are linked to the players’ social interactions.

- **Experience Points** (XP), points gained by the player’s experience or by the evolution of the player’s ability (it includes Zichermann and Linder’s skill points).
Redeemable points are not, in the perspective of this thesis, a kind of points but rather something that the player or the gamified system can do with points, whatever their kind is. Redeemable points must be considered under another game element: virtual currency (Section 9.3.7). In GET7, points are seen as primary game elements.

In GET7, points are used to implement clear and intermediate goals, content unlocking, fun failure and multiple paths game techniques (Table 9.4).

In education, Classdojo (Section 5.3.4) uses a point system to reward desired behaviors with positive points and undesired behaviors with negative points, providing reports that students and parents can access. Barata et al. (2013) used XP in a gamified university course: students performed activities that were awarded with XP. XP provide feedback on how the students were doing, motivating them by instant gratification. A fixed number of XP corresponded to a progress level and levels corresponded to grades.

### 9.3.2 Badges

As Hamari (2013) notes, badges are the blueprint of gamification and they are a common game element used in gamified applications to an extent that, for some gamification detractors, the concept is named “badgification”. According to Hamari, a badge consists of an icon or symbol representing the visual and textual cues of the badge and the rules determining how the badge should be earned. Badges, a visible symbol of accomplishment, can be represented by ribbons, trophies, or other symbols (Kapp et al., 2014).
Badges could be seen as a means to signal a clear goal (Hamari, 2015) or to signal reputation and status. Zichermann and Linder (2013) define badges as tokens representing the achievement of some goal and note that they could be a way for players to show their accomplishments to others and to keep a record of their progress, regarding the gamified system’s goals.

Badges are related with other elements like points (e.g. a certain amount of earned points may lead to a badge) and leaderboards (e.g. a player at the top of the leaderboard may earn a badge signaling that achievement). Badges can be used as a reward mechanism, appealing mainly to extrinsic motivation, and for feedback, which is an important element to experience flow, as seen in Section 6.5. Rughinis (2013b) discusses the intrinsic and extrinsic sides of badges and distinguishes between status badges, those that recognize some achievement, and role badges, to award players that had took some responsibility in a learning activity (e.g. as moderator or as tutor).

According to Paharia (2013) badges appeal also to intrinsic motivators like mastery, progress, purpose and social interaction. This author also points to the entities that are involved in a badging system: builders of infrastructures (like the Open Badges Infrastructure, see below), issuers, the entities that design and issue badges; displayers, that provide systems to collect and display badges; and the earners, those who get the badges.

In a gamified system, badges can be issued by the system according to the gamified system’s rules or can be issued by a special player acting as a mediator (see Figure 9.5).

To summarize, digital badges are a way of setting goals, representing achievement, showing progress and communicate feedback. They can be seen as digital images with metadata (Santos et al., 2013b). Badges can be used in formal and informal learning scenarios and they can promote lifelong learning. They can also drive social interaction by displaying status, sharing and allowing recognition by others.

In the proposed framework, digital badges consider the following features (some are shown as class attributes in Figure 9.4):

- **Who is the earner**: the player that earns the badge;
- **Who is the issuer**: the entity responsible for issuing badges (the system or a special player);
- **Issue criteria or rules**: what the player needs to do to earn badges;
- **Icon**: the visual representation of the badges (a graphical symbol);
• **Textual description**: additional information related to each badge’s meaning;

• **Timestamp**: the date when each badge was issued and, if applicable, an expiration date;

• **Available on profile**: the badge should be stored (in a backpack) and available in the player’s profile; players should be allowed to share the earned badges with others;

• **Authentication**: ensuring that the badge holder is the badge earner.

In GET7, **badges** are used to implement **clear and intermediate goals, time pressure, fun failure and multiple paths** game techniques (Table 9.4).

Concerning education, badges have been used for some time. Joseph (2012) describes six ways to use a badging system in educational contexts as an alternative assessment model or as a way to develop lifelong learning skills. The 2.5 release (May, 2013) of the LMS Moodle, includes badges\(^1\) as “a good way of celebrating achievement and showing progress”. Moodle’s badges are compatible with the Mozilla Open Badges Infrastructure (OBI)\(^2\), a software infrastructure on an open standard that organizations can use to create, issue and verify digital badges. System’s users can combine multiple badges from different issuers and the earned badges can be shared for employment, education or lifelong learning purposes. Within OBI, a digital badge is defined as an online record of achievements, including information about who issued the badge and the effort needed to get it. Badges features include information about who, how and when it was issued and should include sufficient information to provide validation (The Mozilla Foundation and Peer 2 Peer University, 2012). Badges can be collected in an individual *backpack*, a repository that also gives the user the ability to display and share the earned badges and also provides some kind of accreditation, ensuring that the person displaying the badge is the one who earned it. This *backpack* also allows the user to display the badge in other systems, namely SNS.

Most of the educational experiences with digital badges took place in higher education contexts. Domínguez et al. (2013) presented an experiment in a university course with a gamified LMS with several game elements, including badges. They concluded that reward systems and competitive social mechanisms were motivating for students. P2PU\(^3\) is another example of an open education project that uses a badging system aiming at lifelong and informal learning. Rosewell (2012) discusses how badges for learning could fit into the offering of the United Kingdom Open University, and reveals some features

---

\(^1\)http://docs.moodle.org/25/en/Badges
\(^2\)http://openbadges.org/
\(^3\)http://p2pu.org
that badges should have when used in informal learning contexts. Santos et al. (2013b) described how OBI was applied in an institutional higher education PLE to integrate a badging system. Santos et al. (2013a) conducted an experience with a group of students aged from 13 to 15 years old concluding that badges in collaborative learning platforms could be useful in the promotion of users’ engagement and motivation. Other examples of badging systems in educational contexts can be found in Denny (2013), Barata et al. (2013) and Hakulinen et al. (2013).

9.3.3 Leaderboards

Leaderboards or scoreboards (Zichermann and Linder, 2013) are a game element originally created for arcade games\(^4\). These kinds of games are essentially single user video games that gained a social component with the inclusion of leaderboards (Kapp, 2012). With this element, players can see the other players’ names and scores and each player has an additional motivator to play, trying to beat other players’ scores. Leaderboards are then performance comparison game elements that can be applied in single or multiuser contexts (Seaborn et al., 2013).

Seaborn et al. (2013) discuss how to use leaderboards as a social game element. Leaderboards can be collaborative and qualitative and not only quantitative and competitive. In this way, leaderboards are a social game element. According to Seaborn et al., prosocial interactions occur when individuals act in the interest of others. For these authors, leaderboards are defined as “a performance comparison game element” and they propose a framework that uses “prosocial leaderboards”.

Still according to Seaborn et al. there are single and multiplayer leaderboards. When leaderboards are multiplayer, they can also be of near performing peers, high performing peers or near performing friends. These are the kinds of leaderboards adopted in GET7.

Single player leaderboards are simple individual lists of scores, showing the performance of one player. Multiplayer leaderboards displaying rankings of near performing peers are a usual approach in social games. In rankings of high performing peers, players with a lower score may not be present. That may lead to demotivation, which is a drawback for this kind of leaderboards as Kapp et al. (2014) note, emphasizing the use of multiplayer near performing peers leaderboards in learning contexts.

Costa et al. (2013) show how to use a leaderboard to improve behavior change. Their work concern the use of a leaderboard for improving punctuality of participants to regular

\(^4\)Arcade games are games running on coined-operated machines, usually placed in public spaces.
work meetings. The leaderboard in this experiment was a multiplayer leaderboard, ranking high performing peers. The authors concluded that leaderboards are more effective if they are used as a social game mechanic:

Our study showed that leaderboards do give way to positive social behaviors like social comparisons, which were of great importance to the majority of the participants, in particular to assess their improvement or standing.
in comparison to those who were of their interest, as opposed to assessing themselves in the global panorama [...] (Costa et al., p. 33)

In the proposed framework, a leaderboard considers (see Figure 9.7):

- The different kinds of leaderboards, Single Player or Multi Player.
- The data source to build the ranking. This source can be driven by a primary game element (through hasPrimaryGameElement association), like points.
- A release, indicating a time period for the data (e.g. a week or a month), through release period attribute from class Leaderboard.
- The involved players (the Target Player and other players in his or hers Social Graph) or an individual player if the leaderboard is Single Player.
- The number of players (e.g. ranking only the top ten players), shown by number of players attribute in class High Performing Peers, friends interval (class Near Performing Peers), and peers interval (class Near Performing Peers).

In GET7, leaderboards are used to implement the social interactions game technique (Table 9.4).

In education, leaderboards can be an important social game element if correctly used to foster social interactions and avoid the downfalls of competition in this context. Competition is probably the reason explaining why gamified systems in the education sector do not use leaderboards so often. Alternatively, the leaderboard can be anonymous, where each player can only see other players' scores, but not their names, reducing competition among players. It is possible to build leaderboards using already available applications on the Web, like Rise\(^5\), a tool to build rankings of high performing peers.

### 9.3.4 Levels

According to Kapp (2012), games have different types of levels: game levels, player levels and playing levels. *Game levels* are quest-based structures. Players can progress from one level to the next by completing a quest or a challenge. *Player levels* act as ranks for the player’s progression. Players can get different player levels according to performance and progress. Player levels and XP are closely connected. *Playing levels* are a way to deal with players with different skills or to deal with the same player’s progression.

\(^5\)www.rise.global
same game can be played at different playing levels by different players and the same
player can play the same game several times but at different playing levels. Therefore,
each playing level concerns a certain level of difficulty.

For other authors, like Zichermann and Linder (2013), levels are just “structured hierar-
chies of progress”. They can be represented by numbers, colors or some other symbols of
hierarchical values. Still according to Zichermann and Linder, “levels and badges have
a great deal to overlap” and can be used interchangeably.

Hence, in games, *levels* have different meanings. The difference between the above views
of what a *level* is can be clarified by some simple examples. In a game, a player can *level
up* (i.e. upgrade his or hers *player level*) when achieving a certain amount of XP. For
example, a player can level up from *newbie* to *beginner* after earning 1.000 XP. Similar
examples from another context are belt colors in martial arts. A player can also progress
through the game by completing several *game levels*. The player may only start a new
level after finishing the previous level. The sequence of levels are part of a quest that
the player must complete. Finally, in a game, players can also replay the same levels at
different *playing levels*. Each playing level increases the challenge (fighting with more
enemies or completing the level in a shorter time limit). Playing levels make the game
more accessible to different learners and allow the same learner to replay the game at
a higher level. In learning contexts, playing levels provide different information and
challenge, make the learning activity more accessible to different learners and allow the
same learner to replay the same activity at a higher level Kapp (2012).

In the GET7 framework, *levels* will be considered as *playing levels* and as *game
levels*. Game levels are the intermediate goals concerning an activity’s overall goal.

In game environments, goals are also called achievements, challenges, quests or missions
(Murphy et al., 2014; Paharia, 2013). These terms are used to express tangible goals.
In the GET7 framework, a *mission* is the name given to the set of well-defined, clear
and tangible goals for a gamified activity. A mission is neither a game element nor a
game technique. It is just a more game-like term to designate an activity with clear and
intermediate goals (game levels). The set of a mission’s game levels implement the clear
and intermediate goals game technique.

Figure 9.8 shows the levels game element as a set of UML classes. A *Mission* is an
aggregation of game levels. Each *Mission* sets the goals for an *Activity*. In each
level, the player must execute a set of *Target Actions*. These actions are called
target actions because the players can perform other non-gamified actions in the system.
In GET7, **levels** are used to implement **clear and intermediate goals, content unlocking, time pressure, fun failure, and multiple paths** game techniques (Table 9.4).

### 9.3.5 Progress Bars

A **progress bar** is a visual clue with a numeric information (usually a percentage) that shows the player’s progress regarding some previously defined objective. It can be used as a reminder of where the player is at some moment and how far the player is of reaching the objective.

In video games, progress bars are used to show experience gain or players’ “health”. Outside games, one of the most well-known examples is the LinkedIn\(^6\) progress bar. In this example, the progress bar is used to encourage LinkedIn users to add more information about themselves.

---

\(^6\)http://www.linkedin.com. LinkedIn is a business-oriented SNS used for professional networking.
Progress bars relate to other game elements like points and levels. They can be used to provide instant feedback, graphically and by the percentage level. Other similar uses of progress bars are the icons used to show battery levels in portable devices like laptops, tablets or smartphones. Hence, in general, users are accustomed to get information from this kind of visual cue.

In the proposed framework, a progress bar must consider (Figure 9.4):

- The bar’s visual shape, an attribute in Progress Bar;
- The numeric information (a percentage or an absolute value), another attribute in Progress Bar;
- If used as secondary element, the primary element to which the bar depends on (has primary element inherited from Game Element).

In GET7, progress bars are used to implement the clear and intermediate goals game technique (Table 9.4).

In education and training, some LMSs, like Moodle, already have the possibility to add progress bars to cope with students’ progress. Educators also understand that progress bars can be used to communicate students’ progress (Keeler, 2013):

One way to gamify a classroom is to give each student a progress bar or have them maintain one for themselves. As the student earns points the progress bar increases. The student can see tangible growth from their efforts. Progress bars and levels can help students to set goals and celebrate success.

### 9.3.6 Social Graphs

Social graphs, as game elements, are the representations of the players’ social networks within the gamified system. According to Werbach and Hunter (2012), they are the network of relationships among friends, the matrix of connections on a SNS. SNS through their social graphs allow for instant access to friends and social connections at any time and, with the widespread of mobile devices, from everywhere.

In the proposed framework, social graphs are the representations of the relationships between players that consider themselves as friends (in the sense used in a SNS). Players that are friends can have deeper interactions in the gamified system. Players in the same social graph are able to share, cooperate, trade, donate virtual currency, and comment on
their friends activities. These features are expected to increase the levels of interaction and engagement.

Figure 9.5 depicts the social graph game element where this element is just a many-to-
many association class (Social Graph) involving players. Players can be just peers
(attribute is peer), if they are, for example, students of the same class or they can
be friends (attribute is friend), like the same concept from SNS.

In GET7, social graphs are used to implement social interactions and virtual econ-
omy game techniques (Table 9.4).

9.3.7 Virtual Currencies

Virtual currencies are also known as virtual money or in-game currencies and are
used within SNS, virtual worlds and other online communities. Virtual currencies are
used for purchasing virtual goods (Dicheva et al., 2015) or to be redeemed by physical
goods. Trading with virtual currencies takes place within virtual economies (See Section
9.2.7).

Earned achievements in a game (e.g. points or badges) can be used as virtual currency
(Kapp, 2012; Kapp et al., 2014). With virtual currencies, the players exchange an
amount of this currency by virtual goods, donate to other payers, redeem for real world
goods or access other benefits in the real world (e.g. by exchanging currency with some
kind of vouchers). Virtual currencies can also be used to unlock content, allowing the
player to choose what to unlock and when (giving each player autonomy and a sense of
control).

Virtual currency can also be used to trade with other players and it can be donated to
others or to contribute to some cause outside the gamified system context. For example,
in an educational context, the players (students) can donate their virtual currency to
some school project giving them a sense of purpose when using the gamified system.

In the GET7 framework, virtual currencies, a secondary game element, is connected to
a primary game element (typically, points). Besides other purposes already set for the
primary element, it is used as virtual currency to trade in a marketplace operating under
a virtual economy’s rules (Figure 9.9).

In GET7, virtual currency are used to implement content unlocking and virtual
economy game techniques (Table 9.4).

Werbach and Hunter (2012) state a best pratice for the use of virtual currencies in
educational games: “offer players a currency for completing tasks instead of rewards to
give them a greater sense of control. Use a currency system to enhance a game, but don’t attempt to make currency acquisition the main reason players engage in an activity” (p. 232). Here, rewards refer to some kind of incentive in the real-world, like monetary rewards. Allowing players to choose how they spend their virtual money increases their sense of autonomy.

### 9.4 Summary of the Framework’s Components

The psychology theories that deal with human behavior and motivation play a central role in any gamified system. The GET7 framework is founded in the theory of flow with contributions from other psychology theories, presented in Chapter 6. The theory of flow was chosen because it is related to intrinsic motivation, and therefore to the concept of meaningful gamification. It is also one of the most cited theories found in the literature about gamification (Schlagenhauffer and Ambert, 2014). **Fun and Flow** are core concepts in the GET7 framework. These core concepts are completed with the concepts of **Challenge/Skill Balance**, **Autonomy & Control**, **Feedback & Rewards** and **Friends**. From these core concepts emerge the framework’s components: a set of 7 game elements and 7 game techniques.
The GET7 frameworks’s game elements and game techniques provide the basic tools. They were chosen because they were the most cited elements and they are found in many existing applications and empirical research, as seen in Chapters 5 and 7. There is already research about the use of these elements, many of it in educational settings, revealing their value.
Chapter 10

Reference Architecture for GET7

For a software system to support the frameworks’s elements, techniques, and rules, a general architecture is proposed as part of the framework. The reference architecture was developed with a software engineering approach and using an appropriate language, the Unified Modeling Language (UML). The proposed architecture is platform independent. The approach taken for the definition of the architecture followed the Model Driven Architecture\(^1\) (MDA) development cycle for software systems. With MDA, the development cycle starts with the development of a Platform Independent Model (PIM), with a high level of abstraction and independency from implementation technology. The gamified system is modeled on how it best supports the elements and techniques in the GET7 framework.

10.1 GET7 Reference Architecture

The proposed architecture is based on six main building blocks (Figure 10.1), represented as UML packages.

The architecture is a high level view of a gamified system and its purpose is to define which are the main building blocks for such a system. Since the architecture is intended to be platform independent, the proposed architectural model is a PIM, a Platform Independent Model that describes a system with no concerns or knowledge about possible implementation platforms (Kleppe et al., 2003). The architectural model includes several UML class diagrams, some of them already presented in the previous chapter. Classes have no operations defined and only some of the main attributes are shown. Attributes have no defined data-types and no defined visibility (e.g. public or private).

\(^1\)http://www.omg.org/mda/
The proposed architecture, part of the GET7 framework, is a more detailed view of what a framework is, “a set of collaborating classes, arranged to carry out some meaningful portion of an application” (Meilir, 2000, p. 431).

For a better understanding of users’ roles and what tasks they undertake within the gamified system, Figure 10.2 shows the use cases for the different actors: Player, Designer and Special User (cf. Figure 9.5). Two of the use cases Interact with Others and Execute Actions are not exclusively related to the gamified system but they are shown for a better understanding of the Player’s role.

This architecture is a typical three-tier model for a software architecture with a presentation tier (user interface), a logic tier (system logic) and a data tier (data interface). Each tier has two UML packages. These UML packages are the architecture building blocks:

- **Dashboard** (user interface tier): non-playing users (mediators and designers, see Figure 9.5) interact with the system through the Dashboard;

- **Player Profile** (user interface tier): a block acting as the interface between the system and the players;
Chapter 10. Reference Architecture for GET7

10.2 Dashboard

Concerning IS technology, a dashboard is a term used to name a kind of graphical user interfaces. Dashboards organize and present information in a graphical and easy to read
way. This kind of interfaces can be interactive, allowing the users not only to visualize data but also to operate on that data. The term is a metaphor since it originally named an automobile’s control panel displaying data for the driver. The dashboard is made of a set of widgets, small pieces of software able to display a particular type of data.

In the GET7 architecture, the **Dashboard** is destined for non-player users access the system. These users can be special users acting as mediators or the designers of gamified activities. Although, as seen before, these two different roles may be assigned to the same user. Through the dashboard it should be possible to evaluate the results and the behavior change that the gamified activities are producing. It allows the gamification designer to tune the system by changing and improving the rules or by changing the elements and techniques used in an activity. The system is tuned according to some KPI’s (Key Performance Indicators) defined for the gamified activity.

KPI’s are a concept from management where they are seen as indicators to help an organization define and evaluate its success, in terms of making progress towards the organizations’s long term goals. KPI’s are defined by Wu and Chen (2012, p. 4) as “an evaluation basis and target that can concretely reflect important and influential factors in the operations of an organization” and they must be “measurable, attainable, relevant and time-bounded, and can adequately reflect critical success factors in organizational performance”. KPI’s are also used in educational contexts as learning indicators, mainly in higher education but also in basic education (Wu and Chen, 2012). KPI’s can have several dimensions and one of them is an output dimension to deal with students’ learning performance using indicators like learning achievement or behavioral performance. In the GET7 framework, KPI’s are seen as the indicators that reflect the success of gamified activities. They are the metrics to quantify the goals for gamified activities.

The Dashboard is shown in Figure 10.3 as a set of UML classes, along with the Player Profile. The **Dashboard** class is a type of **User Interface** that aggregates a collection of **Dashboard Widgets**. One of those widgets is the interface to set the rules for the gamified activities (**Rule Builder**) governing the framework’s game elements and techniques. These rules are further discussed in Section 10.5. The class **Rule Builder** can be materialized through an interface like the one exemplified in Figure 8.1 from Chapter 8 or by an interface to allow a DSL specification for rules.

Another widget is the **KPI Widget**, an interface to allow non-player users to compare metrics from the players’ actions with the KPI’s of those actions. KPI’s are defined by the gamification designer.
10.3 Player Profile

The **Player Profile** (Figure 10.3) is a block for players to access their profile concerning the gamified system. It is the place to store the player’s achievements, using the framework’s game elements, to report feedback. It is also where the player can set which external applications or SNS are allowed to publish the player’s personal gamification achievements. Regarding badges, this component is similar to the concept of “backpack” in Mozilla Open Badges, discussed in Section 9.3.2. The class association **Elements In Profile** registers the elements earned or achieved by the player and also the leaderboards that the player might participate. Through the profile, each player can also activate or deactivate the possibility to share achievements in an external application. The association **share achievements on** is the link between the Player Profile and the Connections Manager.
10.4 Analytics Engine

The way players get feedback for their actions is crucial. By tracking certain variables related to players’ actions, a gamified system can find patterns, trends and correlations and be able to provide immediate and accurate feedback. Data analytics play an important part in gamified systems, therefore an **Analytics Engine** is part of the GET7 framework. Analytics are the algorithms and data used to measure KPI’s (Werbach and Hunter, 2012).

The Analytics Engine compares system’s KPI’s with data collected from players’ actions. A KPI can be set for every **Action** that players perform in the system (Figure 10.4). Some of those actions can be the gamified system target actions (class **Target Action**). As the Analytics Engine package depends on the Activity Manager (see Figure 10.1) the other classes on Figure 10.4 concern the Activity Manager (Section 10.6).

![Figure 10.4: Analytics and Activity Manager Class Diagram.](image)

10.5 Gamification Engine

A **Gamification Engine** should provide the game elements and the rules to establish the gameplay for the target activities. The **Gamification Engine** is closely related to the Activity Manager and to the Analytics Engine.
A rule (Figure 10.5) is an association between an action performed by a player and a game element (Primary Rule) or an association between game elements: a primary game element and a secondary game element (Secondary Rule). The Rule may be active or inactive and may assert that the action must occur a certain number of times (attribute occurrences) or for a certain period of time (attribute time period). When that number of occurrences is reached or when the time period ends, then the game element is updated by an update value.

Figures 10.6 and 10.7 depict UML activity diagrams that show how rules are processed. These diagrams are further explained in the following section.

---

Figure 10.5: Gamification Engine Class Diagram.

To express the kind of rules envisioned for GET7, a DSL-like approach will be used. The approach is based on the Gherkin language\(^2\), a DSL to describe software’s behaviour without implementation details. Gherkin uses the feature Concept as a list of scenarios. A Scenario is a list of steps using the keywords Given, When, Then, But and And. In the proposed approach, a Scenario details a unique rule.

Following the above approach, a primary rule may have one of the two following general forms:

\(^2\)https://github.com/cucumber/cucumber/wiki/Gherkin
Scenario: a primary rule
Given player is executing some target action
When target action is executed n times
Then update primary element by some value
or

Scenario: another primary rule
Given player is executing some target action
When target action is executed for some time period
Then update primary element by some value

Similarly, a secondary rule may have the following general form:

Scenario: a secondary rule
Given player is executing some target action and 
player has primary element in Player Profile
When primary element equals some threshold value
Then update secondary element by some value

Some practical examples of rules will be given in Section 14.2.5.

10.6 Activity Manager

The Activity Manager (Figure 10.4) is responsible for which players do which tasks, when they do the tasks (attribute timestamp in Action Log), how many times they do them (attribute counter), for how long (attribute time period), and who records these data. The interactions between the players and the gamified system are permanently traced and stored by the Activity Manager. This building block feeds the Gamification Engine. The Mediator (Special User or the System, cf. Figure 9.5) records (in class Action Log) everytime a player executes an Action. The Mediator then checks if the action is a Target Action and decides to accept the action to be processed by the Gamification Engine or to discard the action (see Figure 10.6).

The UML activity diagram in Figure 10.6 shows how the Mediator gets the data for a primary rule and how the rule is processed by the Gamification Engine. When a Player executes a Target Action, the Mediator may accept or discard the action. If the action is accepted, then the Gamification Engine looks for the action’s rule. If
Figure 10.6: Activity Diagram for a Primary Rule.
Figure 10.7: Activity Diagram for a Secondary Rule.
the rule is available and active, then the Player Profile is checked to find if the element (a primary element) is already in the profile. If the element is not in the profile, then the element is added and initialized. Finally, the rule is processed and the Player Profile is updated.

The UML activity diagram in Figure 10.7 shows how a secondary rule is processed. Periodically, the Gamification Engine goes through all the defined secondary rules. For each rule, the Gamification Engine gets the rule’s primary element. Then, for each player profile with the primary element, the engine gets the primary element’s data and the secondary game element defined in the rule. From this point on, the process is similar to the primary rule’s processing, but the secondary game element is only updated if the element value is greater or equal than the rule’s threshold value.

10.7 Connections Manager

The Connections Manager (Figure 10.8) is destined to establish links with the non-game context and to publish the players’ achievements, e.g. badges or trophies, in a social network or other similar applications.

![Connections Manager Class Diagram](image)

Figure 10.8: Connections Manager Class Diagram.
Gamified systems relying on external devices to keep track of what the player is doing need a connection with those devices. These devices must be synchronized, through some kind of physical connection to upload the collected data. Despite of the data collection process may involve connections to external devices, a gamified system may also have connections to social networks and other social applications (represented by the class Social Media).

10.8 Summary

This chapter presented the proposed supporting architecture for the GET7 framework. The architecture is a set of UML diagrams that constitute a Platform Independent Model, following the Model Driven Architecture approach. The architecture was described as a set of UML diagrams, mainly class diagrams. The GET7’s architecture was developed around a set of six main building blocks, represented as UML packages: the Dashboard, the Player Profile, the Analytics Engine, the Gamification Engine, the Activity Manager, and the Connections Manager. Class diagrams from Chapter 9 are included in the Gamification Engine block (subclasses of Game Element class).
Chapter 11

A Guide to Apply GET7

This chapter describes a guide to help gamification designers develop gamified activities with the support of a gamified system based on the framework’s architecture. The GET7 framework is completed with this set of guidelines. The proposed guide is intended to help gamification designers to choose the game techniques and the game elements appropriate to a particular non-game setting and to define the rules concerning those elements and techniques.

11.1 A Guide to Apply Gamification

The guide in GET7 framework was envisioned to help gamification designers to set up gamified activities, in digital or non-digital contexts, by guiding them to choose the appropriate game techniques and game elements and define the rules governing the use of those elements and techniques. The gamification designer is a type of user in gamified systems, as seen in Section 9.3. The designer could also be the mediator in non-digital contexts. The designer must consider activities’ goals and find metrics to quantify those goals (the KPIs). Those goals must meet players’ target behaviors. The designer must also know the activities’ context, the activities’ contents nature and the players’ profiles.

The gamified system, built according to the GET7 architecture, should provide the necessary tools to develop and support the gamified activities. However, although being part of the GET7 framework, the guide can be used independently. The guide will be best used if the gamified activities are supported by a system built accordingly to the GET framework’s architecture but it can also be used with other systems providing that those systems allow the use or access to the GET7 game elements and also, in some way, support the GET7 game techniques.
Chapter 11. *A Guide to Apply GET7*

The guide is needed for the design of gamified activities because, as already discussed, gamification is not just adding game elements in some already existing non-game. That can be easily done with some of the many existing tools and platforms like the ones presented in Sections 5.4.1 and 5.6 (see Tables 5.1, 5.2 and 5.3). Game elements must implement game techniques and that, in GET7, aim to keep players in the flow channel when using the system in order to achieve meaningful experiences. These experiences must increase players intrinsic motivation instead of just provide the players some kind of rewards.

The gamification designer should first be aware of what is to be gamified. What to gamify and what are the benefits in motivating the players to change their behaviors. What behaviors need to be changed (the target behaviors) and what are the appropriate activities (target activities) that can make this change happen, should be the first concern of the designer. The designer must also be aware of the context’s nature and of the players’ profiles.

In summary, the proposed guide will help the designer to:

- Understand the activities’ context and the players’ profiles in order to create challenges (missions) tailored to the player’s skills, increasing the difficulty of these challenges as the players acquire new skills. The choice for a more competitive or more collaborative environment must be made regarding the context and the players. The activities must be closely connected to the players’ target behaviors.

- Set concrete goals for the activities that must be measurable and adequate to the players intended skills. Proper metrics must be chosen for those goals. These metrics are the activities KPI’s that, in a learning context, will be learning indicators concerning students’ work and progress.

- Choose the proper game techniques and game elements, regarding the context, the players and the activities’ goals. The designer should know the game techniques, each technique’s purpose (i.e. how the technique addresses the framework’s core concepts) and which game elements can implement each technique.

- Set up rules regarding how the techniques and the elements are applied, considering the previous point.

- Assure the players understand the activities, their goals and the rules. Goals must be clear for the players that should also know the activities’ rules.

- Assure the players receive appropriate and fast feedback for their actions and are able to access their profile (a space where the players can see how they are doing and what they have already achieved).
- Redefine and tune the gamified environment, in a iterative way, if the KPI’s are not met.

The guide is inspired on the Werbach and Hunter (2012) and Marczewski (2013b) proposals (see Section 5.5). The GET7 guide has seven steps that the designer should consider in order to set the gamified activity. Each step may produce information for the designer, for the players or for both. The guide is detailed in Table 11.1.

**Table 11.1: Framework’s Reference Guide**

<table>
<thead>
<tr>
<th>Steps</th>
<th>What to do</th>
<th>Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Activity and context characterization</td>
<td>Describe the context nature, characterize the players, define the target behaviors and the corresponding target activities</td>
<td>For the designer: a description of the context nature, identifying the players, the target behaviors and the target activities</td>
</tr>
<tr>
<td>2. Define the activity goals</td>
<td>Define which are the goals for the target activities and how they are quantified</td>
<td>For the designer: a description of the missions with clear and quantifiable goals (KPI’s) for each one</td>
</tr>
<tr>
<td>3. Apply the 7 game techniques</td>
<td>The designer should have a clear view of the game techniques and a knowledge of how to apply them and then choose the techniques regarding the previous steps</td>
<td>For the designer: a description of the missions and levels with clear and quantifiable goals (KPI’s) for all of them; a description of the other game techniques</td>
</tr>
<tr>
<td>4. Apply the 7 game elements</td>
<td>The designer should have a clear view of the set of available game elements and a knowledge of how they will be used to meet the game techniques and then choose the elements to apply</td>
<td>For the designer: a description of how and when game elements will be used; For the players: a description of the missions and of each mission’s levels, with clear and quantified goals for all of them</td>
</tr>
<tr>
<td>5. Set the rules</td>
<td>Define the rules to apply</td>
<td>For the designer: a formal description of the rules; For the players: a text description of the rules</td>
</tr>
<tr>
<td>6. Deploy the solution</td>
<td>Insert the rules in the system and start the activity (monitor players’ activities if the context is non-digital)</td>
<td>For the players: the gamified system with the implemented target activities</td>
</tr>
<tr>
<td>7. Evaluate the results</td>
<td>Observe the target behaviors and readjust the activity if the behaviors are not observed</td>
<td>For the designer: a list of metrics from data obtained from the players’ actions, to be compared with the activities’ KPI’s</td>
</tr>
</tbody>
</table>

### 11.2 Context Characterization

The first issue to consider is the context nature. Is the activity going to take place entirely in a digital context? Or is the platform just going to be used to support something that
will take place in the real world? If so, a mediator will be needed: a human mediator or some kind of device? The gamification designer could also be the human mediator, a special system’s user that will be responsible for inserting the gamification data (Table 11.1: step 6). These two different contexts are shown in Figure 8.3 (Chapter 8): the digital context on the right side of the figure and the non-digital context on the right side.

Then the designer should identify players’ target behaviors. The designer must choose the activities that will trigger those behaviors. The decision to design a more competitive or more cooperative system must take into account who the players are. Understanding the players’ profiles is mandatory in the selection of the appropriate game elements and in the setting of the system’s game techniques and rules. It is also important to note that players are different and therefore, in the same group, there will be individual differences.

For the context characterization, the designer should find out what is making players less likely to execute the target behaviors. That could be due to a lack of motivation or to insufficient capabilities. When defining the target activities, the designer must choose activities adequate to the current players’ skills but able to evolve as the players’ skills improve.

In this step, the designer should found an answer to each of the following questions:

- What is the context nature?
- Who are players?
- Which are the target behaviors?
- Which are the target activities?

At the end of this step, the designer should have a description of the target activity and of the target behaviors (Table 11.1: step 1, deliverables). It should also include the context characterization and a description of the players.

### 11.3 Activity Goals

After the identification of the target behaviors in step 1, the goals for the gamified system should then be set according to the target behaviors. These goals must be quantified with the appropriate metrics (Table 11.1: step 2). These metrics are the activities’ KPI’s.
In this step, the designer should found an answer to each of the following questions:

- Which are the goals for the target activities?
- How are the goals quantified?

This step should provide, for the designer, a description of the activities (the missions) with quantified goals (the KPI's), as shown in Table 11.1: step 2, deliverables.

### 11.4 Apply the 7 Game Techniques

When the missions are set, then the designer should apply the game techniques accordingly to the missions’ goals (Table 11.1: step 3). Each mission is split in several levels. Each level has an intermediate and quantifiable goal.

The designer should be aware that the purpose of game techniques is to keep players in the flow channel (cf. Figure 9.2). Regarding this purpose, in this step, the designer should have a clear understanding of the available game techniques and how to apply them:

- **Clear and intermediate goals**: this technique is relevant to keep a balance between the missions and levels’ challenges and the players’ skills. The technique is also a way to increase the players’ senses of autonomy and control. Clear and intermediate goals keep players in the flow channel.

- **Content unlocking**: a progressive content unlock, as a result of players’ performance, is a way to keep the balance between challenges and players’ skills. The technique also provides feedback and is also a way to reward players. The technique avoids a feeling of boredom if the players’ skills are above the challenge’s difficulty level.

- **Time pressure**: setting time limits to complete a task is a way to increase players’ motivation when their skills surpass the challenge. The technique also avoids a feeling of boredom if the players’ skills are above the challenge’s difficulty level.

- **Fun failure**: the technique allows the repetition of each mission/level until player’s success. It avoids players’ anxiety if their skills are above the challenge’s difficulty level. Players should be allowed to repeat some tasks until they succeed. It is also a way to provide feedback, in a fun way, if possible, to avoid a feeling of frustration.
• **Multiple paths**: this technique also avoids players’ anxiety by letting each player to choose their own path towards an objective. The technique also provides a sense of autonomy and control.

• **Social interactions**: used to allow players to interact according to their social graph. Through social interactions players can get feedback from others and share achievements.

• **Virtual economy**: with this technique, game elements, like points, are used as currency. The technique increases the players’ senses of autonomy and purpose and is a way for players to interact with each other.

In the end, this step should provide (Table 11.1: step 4, deliverables):

• For the players: a description of the missions (the overall goals) and levels (intermediate goals). All goals must be quantified.

• For the designer: a description of how the game techniques will be applied regarding the missions and levels’ goals. Missions and levels’ goals are the KPI’s for the gamified system.

### 11.5 Apply the 7 Game Elements

Game elements (Table 11.1: step 4) should be chosen accordingly to the game techniques. In this step, the designer should have a clear understanding of the set of available game elements and know how those elements will be used to meet the game techniques. The designer should understand the relation between the game elements and the game techniques (Table 11.2):

• **Points**: to be used with clear and intermediate goals, content unlocking, fun failure and multiple paths.

• **Badges**: to be used with clear and intermediate goals, time pressure, fun failure and multiple paths. Badges can be connected to points.

• **Leaderboards**: to be used with social interactions. Leaderboards depend on other game elements, like points.

• **Levels**: to be used with clear and intermediate goals, content unlocking, time pressure, fun failure, and multiple paths. Levels include players levels and game levels (Section 9.3.4). Player levels may depend on points or badges.
• **Progress bars**: to be used with **clear and intermediate goals**. Progress bars depend on other game elements, like points, badges or game levels.

• **Social graphs**: to be used with **social interactions** and **virtual economy**.

• **Virtual currencies**: to be used with **content unlocking** and **virtual economy**. Virtual currencies depend on other game elements, mainly, points.

The designer should be aware that some elements (the secondary elements) depend on other game elements (the primary elements) as explained in Section 9.3. In the design process, these dependencies must be defined.

Table 11.2: Game Elements and Game Techniques

<table>
<thead>
<tr>
<th>Game Element</th>
<th>Game Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>Points</td>
<td>Clear and Intermediate Goals,</td>
</tr>
<tr>
<td></td>
<td>Content Unlocking,</td>
</tr>
<tr>
<td></td>
<td>Fun Failure,</td>
</tr>
<tr>
<td></td>
<td>Multiple Paths</td>
</tr>
<tr>
<td>Badges</td>
<td>Clear and Intermediate Goals,</td>
</tr>
<tr>
<td></td>
<td>Time Pressure,</td>
</tr>
<tr>
<td></td>
<td>Fun Failure,</td>
</tr>
<tr>
<td></td>
<td>Multiple Paths</td>
</tr>
<tr>
<td>Leaderboards</td>
<td>Social Interactions</td>
</tr>
<tr>
<td>Levels</td>
<td>Clear and Intermediate Goals,</td>
</tr>
<tr>
<td></td>
<td>Content Unlocking,</td>
</tr>
<tr>
<td></td>
<td>Time Pressure,</td>
</tr>
<tr>
<td></td>
<td>Fun Failure,</td>
</tr>
<tr>
<td></td>
<td>Multiple Paths</td>
</tr>
<tr>
<td>Progress Bars</td>
<td>Clear and Intermediate Goals,</td>
</tr>
<tr>
<td></td>
<td>Badges,</td>
</tr>
<tr>
<td></td>
<td>Levels</td>
</tr>
<tr>
<td>Social Graphs</td>
<td>Social Interactions</td>
</tr>
<tr>
<td></td>
<td>Virtual Economy</td>
</tr>
<tr>
<td>Virtual Currencies</td>
<td>Virtual Economy,</td>
</tr>
<tr>
<td></td>
<td>Content Unlocking</td>
</tr>
</tbody>
</table>

This step should provide, for the designer, a description of when and how the game elements will be used (Table 11.1: step 5, deliverables).

## 11.6 Set the Rules

The rules (Table 11.1: step 5) should be defined accordingly to the way that rules can be set in each particular system. As seen in Section 8.4.1, rules can be set through the dashboard, using a pre-established interface, or they can be set using a DSL. Concerning each one of this options, in the end of this step, the designer should have a formal description of the rules, suited to the rules definition method of the adopted platform.
This step should provide (Table 11.1: step 6, deliverables):

- For the players: a text description of the game rules, written in a way that players can easily understand.
- For the designer: a formal description of the rules, according to the way that rules are set in each particular platform.

11.7 Deploy the Solution

After the rules are set and inserted in the system, the gamified activity is deployed (Table 11.1: step 6). During the activity, players access their profile and they will be able to see the earned badges, the amount of points or the leaderboards. The designer accesses the Dashboard to monitor players’ actions in order to be able to tune the gamified activity. If the context is non-digital or mixed (both digital and non-digital), the mediator (most likely the same user as the designer) must collect gamification data from the players’ actions to be inserted in the system.

At the end of this step, the players must be able to start the gamified activities (Table 11.1: step 7, deliverables).

11.8 Evaluate the Results

When players start the gamified activities, the system monitors their actions and collects relevant data according to the goals (the KPI’s) that were set for the activities (Table 11.1: step 7). Data is analysed and the actions of the players are evaluated against the KPI’s from step 2. If the target behaviors are observed then the gamified activity accomplished its objectives. If not, the designer must tune the activity, finding if the goals were clearly defined, if the players were getting rapid feedback, if they were able to control their actions or if they felt overwhelmed by the system. Missions (the overall goals) and levels (the intermediate goals) should also be balanced with the players skills during all the activity. The target behaviors are observed for an activity if the data gathered from the players actions within the activity meet the KPI’s that were set for the activity.

To summarize, at the end of this step, if the target behaviors are not observed, the designer should consider a redefinition of all the gamification process by asking the following questions:
• Goals were clear?
• Feedback was immediate?
• Players were in control?
• Missions and levels were balanced with the players’ skills?

At the end of this last step, the designer must be able to compare the KPI’s that were set for the activities with the actual data obtained from the players’ actions.

11.9 The Guide in Learning Settings

When applied in learning settings, the GET7 framework’s guide should enable teachers to organize their activities considering the following guidelines (Simões et al., 2013a):

• Allow for repeated experimentation: learning activities should allow repeated experimentation in order to reach a goal, without any failing penalty.
• Include rapid feedback cycles: immediate feedback helps students improve their strategy and get a better chance of success.
• Adapt tasks to skill levels: overall and intermediate goals adapted to students’ skills improve their motivation and let them realistically believe in their chances of success.
• Increase tasks’ difficulty as students’ skills improve: adapting tasks to the students’ skill levels improves their expectations on completing the task successfully.
• Break complex tasks into shorter and simple sub-tasks: allowing students to complete small sub-tasks within a larger task helps them to deal with complexity in a divide and conquer approach.
• Allow different routes to success: each student should be able to choose a different sequence of tasks, choosing the more appropriate path to complete the tasks.
• Allow the recognition and reward by teachers, parents and peers: being rewarded and appraised promotes students’ social status.

With the guide it is intend to reach the following objectives for students and teachers:

• Help students to deal with failure as part of the learning process and avoid feelings of anxiety or boredom;
• Increase students’ disposition to experience flow when performing school activities;

• Develop a school-based identity, improving students’ engagement with learning in a long term basis;

• Motivate students to improve their skills with social rewards, peer and teachers recognition and other incentives;

• Motivate teachers to reward students’ progress.

11.10 Summary

This chapter described the GET7 framework’s guide designed to help a gamification designer to follow a defined and structured path towards the definition and setting of gamified activities. The guide, with seven steps, delivers instructions for both the designer and the players. The guide was described in a general way, aiming no specific context, but can be easily applied in learning contexts to help a teacher (the designer) to set up gamified learning activities. The teacher can also act as a mediator if the learning activities take place in a physical environment with a digital platform, based on the GET7 architecture, being used to support those activities. The gamified activities design process is iterative. The final step of the guide evaluates the process, i.e., if the players are acting accordingly to the target behaviors. If not, the gamified activity can be redefined or tuned in order to meet this goal.
Part IV

Thesis Validation
Chapter 12

Schoooools: Gamification of a Social Learning Environment

This chapter presents the Social Learning Environment, Schoooools, used in the thesis experiment, described in the next chapter. Schoooools’s users, children from 6 to 12 years old (K-6), as with most LMSs and SLEs users, often need motivation to increase their participation and to be involved in the platform activities. From this starting point, the gamification of Schoooools aimed the promotion of users’ engagement and fidelity and to foster students’ motivation.

12.1 Schoooools: A Social Learning Environment

Schoooools\(^1\), known in Portugal as “escolinhas.pt” and validated in several Portuguese schools, is a fully functional K-6 SLE (Simões and Aguiar, 2011). A SLE like Schoooools takes advantage of the benefits of social learning without putting young students’ safety at risk. As social networks create participatory environments, open social media sites have issues concerning online predators, cyber bullying, access to inappropriate content and other undesirable situations. These issues can be addressed by the use of appropriate digital environments, specifically designed for the needs and constraints of young students.

Most of the technology-enhanced learning environments, like many LMSs, were not initially designed to be used by young students, particularly in their first years of education. LMSs are usually less intuitive, with low usability and with workflows that are not adapted to this particular kind of users. Therefore, these users require more

\(^{1}\)http://schoooools.com
specific training than would be desirable in the current technological environment of today’s world. Consequently, this misfit to technological reality, implies that the adoption of these platforms in the communities of elementary schools is usually much more difficult than would be expected by digital native students and teachers with computer skills. But, as Nolan and McBride (2013) state, “a growing number of early childhood scholars are advocating the inclusion of digital technology and culture in early childhood education” (p. 2).

Thus, specifically for the educational context of elementary education, Schoooools (Figure 12.1) was developed to provide a simple, safe and easy way to use a learning environment designed specifically for the first years of elementary education. Schoooools was developed to be a very simple SLE targeted to schools and students from 1st to 6th grade. It follows a wiki-way philosophy for the co-creation of contents. It combines features of Web 2.0 relevant for schools, simplified and integrated in a single platform: easy-to-use content editors, wikis, blogs, private social networks, image galleries, calendars, private messages, chat, shared files, micro-blogging, integration with traditional LMSs (ex: Moodle), and integration with contents from other providers.

FIGURE 12.1: The SLE Schoooools.
The platform aims to enable young students, parents, and educators to benefit from the educational potential of Web 2.0 technology. It includes Web 2.0 features, developed exclusively for its target audience. Aspects of usability, simplicity and feature development had this audience in mind. Security and data privacy issues are particularly sensitive and the platform provides a suitable and safe environment for its users. The platform addresses young users’ needs for controlled environments, that must be simple to use, educational, fun, engaging, and seamlessly ensuring safety, privacy, and self-regulation. The physical school, has a key role in the use of the platform, contributing to a safe and controlled use of the available tools and its contents. Parents also have the opportunity to participate actively. Like in the physical school’s environment, students, parents and teachers have different features and responsibilities, but they all may communicate and collaborate, with privacy rules similar to the physical school and its respective community. The platform promotes a gradual adoption of the best practices on using ICT for educational purposes: in classroom or extracurricular contexts, inside or outside schools.

Schoooools.com includes a private social network with features similar to well-known SNS, like Facebook. Schoooool’s social network is a safe environment where users can build a network of friends (a social graph). Within the network, users can communicate with each other, watch and comment friend’s profiles and watch and comment shared images, photos and projects built with the platform’s tools.

To summarize, Schoooool was designed with three principles in mind:
Chapter 12. Schooool: Gamification of a Social Learning Environment

- Educational, by providing collaborative web spaces to use in the classroom, at home or from any other place, for educational purposes;

- Entertainment, by providing appealing spaces and features to use also in leisure time, to learn by playing;

- Social, by providing an engaging space to promote the communication and socialization within a private social network.

Figure 12.2 shows an example of an activity made by a student within the platform.

12.2 Gamification of Schoool

Schoool's users, as with most other technology enhanced-learning environment’s users, often need motivation to increase their participation and to be involved in the platform activities. From this starting point, the gamification of the Schoool was envisioned as a way to promote users’ engagement and fidelity and to foster students’ motivation.

![Figure 12.3: The SLE Schoool with Gamification Tools: Contexts of Use.](image)
Schooolool, as a gamified system, is a system where the non-game context is digital (the SLE itself, left side of Figure 12.3) but also supports activities in the classroom, a non digital context (right side of Figure 12.3). The teacher is a special user acting as mediator, the interface between the gamified SLE and the outside, non-digital world. The players (the students that are the Schooolool’s users) are passive players.

The gamified version of Schooolool, in its current release, results from the existing system powered with game elements. Some game elements already existed in Schooolool, like the social graph. Other game elements were built using existing gamification tools, like the Open Badge Designer (see Table 5.2), used to build badges applied in the experiment described in Chapter 14 (Figure 12.4) or like Rise to build leaderboards (see Table 5.2). Other game elements, like levels, were simulated using Schooolool existing features.

---

Figure 12.4: Schooolool’s Badges (Built with External Tool).

---

To summarize, Schooolool was enhanced with the following game elements:

- Points (simulated using existing features);
- Badges (built using an external tool);
- Leaderboards (built using an external tool);
- Levels (simulated using existing features);
- Virtual currency (simulated using existing features);
- Social graphs (an existing feature).
12.3 Summary

Schoooools is a platform that follows the general principles of a SLE for basic education. The platform features allow the co-creativity, search functionalities, creation, communication and collaboration. The technology is used as a support to school activities allowing networked learning. All elements of the school community are involved aiming to reduce the digital gap between generations. The platform also promotes both formal and informal learning.

Schoooools as a gamified system is a system where the non-game context is digital (the SLE itself) but also allows the teacher to monitor the students’ activities and act as the mediator in the gamified learning environment. Schoooools was gamified by using existing features and by using external gamification tools.
Chapter 13

Measuring Flow and Engagement

This chapter discusses students’ engagement and how to assess it. The disposition to experience flow is pointed as a measurement of engagement. Flow can be assessed through psychometric surveys using appropriate scales. One of those scales was chosen to be used in the thesis experiment, detailed in the following chapter. The scale’s features are explained in this chapter. The scale was pilot-tested before its use in the thesis experiment. The procedures and the results of the pilot test are also presented.

13.1 Student Engagement

According to the online Oxford Dictionary\(^1\), *engagement is the action of engaging or being engaged*. To be engaged means to participate or become involved in an activity or to establish a meaningful contact or connection with something. Engagement is a wide concept and can be defined in different contexts with different indicators to measure it. In education, it is often related to how students participate in the learning process:

Student engagement can be defined as a students’ willingness to actively participate in the learning process and to persist despite obstacles and challenges. Indicators of student engagement include class attendance and participation, submission of required work, involvement in the learning environment, and participation in the extra-curricular learning opportunities provided on their campus. (Miller, 2011, p. 2)

Engagement in learning is also seen as the measure of a student’s participation in a learning task (Charles, 2010). According to Newman cited by Miller (2011, p. 2),

\(^1\)http://www.oxforddictionaries.com/definition/english/engagement
student engagement occurs when “students make a psychological investment in learning and try hard to learn what school offers”. Also Reeve (2012) states that “engagement refers to the extent of a student’s active involvement in a learning activity” (p. 150).

Engagement is an important metric for success in gamification (Muntean, 2011). Since the concept is mainly used in software applications, engagement in gamification is closely related to user engagement with a software system. User engagement refers to the quality of the user experience. It emphasizes the positive aspects of the interaction with a web application. Users will want to use the application longer and frequently.

User engagement with technology is defined by O’Brien and Toms (2008) as “a quality of user experiences with technology that is characterized by challenge, aesthetic and sensory appeal, feedback, novelty, interactivity, perceived control and time, awareness, motivation, interest, and affect” (p. 949).

Crossing the above three views, student engagement, engagement with technology and engagement in gamification, student engagement in a gamified SLE is the involvement of students in learning activities that take place or are supported by the SLE. Gamification aims to increase not only the students experience as SLEs users, in order to improve the frequency and the time spent in the environment, but also to increase the involvement with the learning contents.

13.2 Assessing Engagement

According to Monterrat et al. (2014), methods for measuring engagement are human-based (self-reports or observation of their actions), hardware-based (e.g. by using eye-track devices) or software-based (that can be automated in web-based applications). Measures of students’ engagement with a technology-enhanced learning environment usually follow a software-based approach, applying the same metrics generically used to measure users’ engagement with software applications. Some common metrics are the average users hits, average page views per visit and user, average time spent on site by users, frequency of visits, participation and conversions, among others (Beer et al., 2010; Muntean, 2011). From the digital marketing perspective, this is an adequate approach. For example, this approach is used to measure a website’s users loyalty. Zichermann and Linder (2013) also gave some indicators that give insights about how to measure users’ engagement in a digital context. Within gamified systems, Zichermann (2012) also identified the 3F drivers for engagement (Section 9.1). But, measuring student engagement only by the students’ use of some learning platform (e.g. a LMS or a SLE) will measure students’ engagement with the platform and not with the learning process. In the proposed approach and framework, the gamified system, as a whole, includes
the activities that take place in the platform but also activities that take place in the physical world and are registered in the platform. A wider approach is needed to measure engagement in a learning activity within a gamified technology-enhanced learning environment. In this research work, the disposition to experience flow, considered as the same as game-like engagement (Section 8.5), was used as a measure for student engagement.

Several researchers already studied the relation between flow and student engagement, like Whitson and Consoli (2009). In technology-enhanced learning environments, Esteban-Millat et al. (2014) presented an overview of the study of flow in virtual environments and proposed and tested a model of flow in e-learning systems.

### 13.3 Measuring Flow

As seen in the previous section, the disposition to experience flow will be used to measure student engagement. The higher the disposition to experience flow performing some activity, the higher the engagement with the activity will be. But, how can flow be measured? Known methods for measuring flow are the Experience Sampling Method (ESM) and psychometric surveys (Shernoff et al., 2014). ESM measures the participants’ experiences at random moments (Shernoff et al., 2003) and is considered the most widely used method for measuring flow. However, in this thesis’ research, the ESM was not easy to implement due to the experiment’s context and, therefore, it was chosen a psychometric survey, the Dispositional Flow Scale-2 (DFS-2), proposed by Jackson and Eklund (2002). This scale assesses the tendency of experiencing flow and is also a widely used instrument to measure flow (Hamari et al., 2014). The DFS-2 has been applied to the study of various physical activities, education, arts and digital gaming and has also been used in research of flow in gamification (Hamari and Koivisto, 2014).

### 13.4 The Dispositional Flow Scale-2

The DFS-2 is a self-report instrument designed to assess flow experiences from the nine-dimensional flow model proposed by Csikszentmihalyi (1990), described in detail in Section 6.5. The nine dimensions of flow can be seen in Table 13.1 (column A).

---

2 The branch of psychology that deals with the design, administration, and interpretation of quantitative tests for the measurement of psychological variables such as intelligence, aptitude, and personality traits, psychometric. (n.d.) The American Heritage Medical Dictionary. (2007). Retrieved from http://medical-dictionary.thefreedictionary.com/psychometric
According to Gouveia et al. (2012), Jackson and Eklund initially developed a multi-dimensional self-report measure of the flow state, the Flow State Scale (FSS), based on the definition of the flow dimensions. Later, they constructed an identical measure to assess the typical frequency in which the individual experiences flow states, named the Dispositional Flow Scale (DFS) and after that another version named DFS-2 was launched. These instruments are used to assess the flow state in participants of physical activities, although it can be adapted to other contexts like educational contexts. While the FSS examines the flow experience in a given situation, the DFS assesses the tendency of experiencing flow. The DFS-2 will focus on activities in which the respondents have invested psychic energy: activities of importance to the respondents, where they are likely to encounter a challenge, and for which they have developed some skills. This is the kind of activities that can lead to flow experiences.

Both the FSS and the DFS have long (36 items) and short (9 items) versions. The DFS-2 long version was chosen because it has a Portuguese-language version, and also following Jackson et al.’s (2010) recommendation that this version (the DFS) should be used to assess subjects whose activity does not involve movement or some kind of physical activity. In the long version, there are four items for each of the nine flow dimensions. The items in the dispositional scales are rated on a 5-point Likert scale, ranging from 1 (never) to 5 (always). The Likert scale is a psychometric scale used in research that employs questionnaires and was chosen because, according to Esteban-Millat et al. (2014), this kind of scales are widely used in the literature about online flow. The long DFS-2 scales are designed to be used as a dispositional flow assessment, with responses indicating the frequency with which flow is experienced in the target activity in general. Therefore, responses should be given at a time that is not directly associated with taking part in the activity being assessed.

Both scales have been used in several flow studies and proved to be robust instruments that provide a detailed assessment of the dimensional flow model. It is only when these dimensions are experienced together that flow is thought to occur (Jackson et al., 2010). The scales are recommended to be administered to a target population with at least twelve years old individuals but can be administered to younger children in a read-aloud administration. This is a relevant issue regarding the experiment’s subjects (Section 14.2.3).

Item samples from the original and the Portuguese versions of the DFS-2 are shown in Appendix A.
13.5 Pilot-Test with the Dispositional Flow Scale-2

The DFS-2 was used in the experiment described in Chapter 14. Prior to the experiment and following Easterbrook et al.’s (2008) advice, the data collection and analysis procedures were pilot-tested. The setting for this pilot-test was a class of 27 students from a professional computer science course at Escola Profissional de Esposende (Portugal), with an average age of 16 years old. These students (all male) can be considered as “hard core” gamers with special focus on MMORPG. For the pilot-test, the students were asked to play the MMORPG League of Legends\(^3\) in one day and they answered the DFS-2 questionnaire (Portuguese version) in the following day. From the 27 students, 24 participated in the test.

Table 13.1 is the table proposed by Jackson and Eklund (2002) to score the DFS-2. Four items (column B) are considered for each of the nine flow dimensions (column A). The item numbers on column B are taken from the DFS-2 questionnaire (Appendix A). Column C shows the average of the total item scores (considering the 24 subjects of the pilot-test) for each dimension, divided by four, to obtain flow dimension item-average scores (column D). A total scale score can also be obtained by summing the item-average dimension scores from column D. The value shown in Table 13.1 (35.35) for the total scale score, is the average of the total scores taken from all subjects. Clear goals (D3) was the dimension with a higher average score (4.16) and the loss of self-consciousness was the dimension with lower average score (3.45).

<table>
<thead>
<tr>
<th>A DFS-2 Dimensions</th>
<th>B Items</th>
<th>C Dimension Total</th>
<th>D Item-Average Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1. Challenge-Skill Balance</td>
<td>Q1+Q10+Q19+Q28</td>
<td>15.79</td>
<td>3.95</td>
</tr>
<tr>
<td>D2. Merging of Action and Awareness</td>
<td>Q2+Q11+Q20+Q29</td>
<td>14.29</td>
<td>3.57</td>
</tr>
<tr>
<td>D3. Clear Goals</td>
<td>Q3+Q12+Q21+Q30</td>
<td>16.63</td>
<td>4.16</td>
</tr>
<tr>
<td>D4. Unambiguous Feedback</td>
<td>Q4+Q13+Q22+Q31</td>
<td>16.54</td>
<td>4.14</td>
</tr>
<tr>
<td>D5. Concentration on the Task at Hand</td>
<td>Q5+Q14+Q23+Q32</td>
<td>15.88</td>
<td>3.97</td>
</tr>
<tr>
<td>D6. Sense of Control</td>
<td>Q6+Q15+Q24+Q33</td>
<td>16.46</td>
<td>4.11</td>
</tr>
<tr>
<td>D7. Loss of Self-Consciousness</td>
<td>Q7+Q16+Q25+Q34</td>
<td>13.79</td>
<td>3.45</td>
</tr>
<tr>
<td>D8. Transformation of Time</td>
<td>Q8+Q17+Q26+Q35</td>
<td>15.83</td>
<td>3.96</td>
</tr>
<tr>
<td>D9. Autotelic Experience</td>
<td>Q9+Q18+Q27+Q36</td>
<td>16.21</td>
<td>4.05</td>
</tr>
<tr>
<td>Total Scale Score (sum column D)</td>
<td></td>
<td>35.35</td>
<td></td>
</tr>
</tbody>
</table>

The scores from Table 13.1 are also shown in Figure 13.1. The horizontal axis has the item-average scores (column D from Table 13.1) for each of the nine flow dimensions.

\(^3\)http://euw.leagueoflegends.com/
The vertical axis corresponds to the 5-point Likert scale used on the questionnaire. Each boxplot\(^4\) in Figure 13.1 shows the results for each of the nine flow dimensions.

![Boxplots of DFS-2 Scores](image)

**Figure 13.1:** Pilot-test: Boxplots of DFS-2 Scores.

It was expected that the analysis procedure would find high levels in the subjects disposition to experience flow while they play the game. In fact, the results in Table 13.1 showed that the average total score was high (35.35).

The test was relevant to set up a proper analysis procedure to apply in the experiment (Chapter 14). The results from the pilot-test were also used as reference values to compare with the experiment’s results. The activity in the pilot test was considered as highly engaging with the participants achieving high DFS-2 scores, as it was observed.

\(^4\)A boxplot depicts groups of numerical data through their quartiles. Box plots have lines extending vertically from the boxes (whiskers) indicating variability outside the upper and lower quartiles. The depicted boxplots are modified boxplots because the whiskers indicate outliers (observation points that are distant from other observations), plotted as individual points. The line in each box indicates the median for the corresponding dimension.
13.6 Summary

The DFS-2 was chosen as an instrument to measure a person’s disposition to experience flow while performing a given activity. This flow disposition is considered in this thesis as a psychological state related to the person’s engagement with the activity, revealing high motivation to accomplish its goals. This was the approach followed in the thesis’ experiment, described in the next chapter. Prior to the experiment, a pilot-test was conducted to test the Portuguese version of DFS-2 and to find reference values from an activity considered as highly engaging.
Chapter 14

Experiment

In this chapter, the experiment designed to validate the thesis statement is described in detail. The guide that is part of the proposed framework was evaluated. An experiment was conducted within a controlled environment where the GET7 framework was applied. The chapter explains the kind of experience that was used and why it was chosen. Issues related to the validation of the experiment are also addressed along with the threats to the experiment validity. A detailed description of the experiment is then presented followed by an explanation of how it was run and how the results were processed. The chapter also includes discussions about the obtained results from the guide evaluation and from the experiment.

14.1 Gamification Guide Evaluation

The guide proposed within the GET7 framework (Chapter 11) was used by trainees attending an e-learning introductory gamification course\(^1\). This course was delivered by TecMinho\(^2\) to formal education teachers and professional trainers. The course took place in March and April, 2015. The course attendants (trainees) were asked to use the guide to gamify an activity of their choice but related to each one’s professional context. It was assumed that the activity would be implemented in an hyphotetic gamified LMS, with a set of features that were presented to trainees. This hyphotetic platform included the seven game elements proposed in the GET7 framework and trainees were told to apply the seven game techniques from GET7. The reason to use this theoretical platform and


\(^{2}\)A Portuguese private non-profit association whose mission is to be an interface of the University of Minho, promoting its connection to society, especially in the areas of science and technology, http://www.tecminho.uminho.pt/
not use Schoooools, the environment used in the controlled experiment, was that the trainees have different backgrounds and they teach at different educational levels, from basic education to higher education and also professional training. The Schoooools SLE would not be suited to be applied in those different contexts. Also, in this way, the guide could be validated in activities in different learning scenarios.

All of the trainees used the guide successfully (steps 1 to 5) and were able to set up a gamified activity according to the proposed objectives. Table 11.1 was adapted to a more friendly layout (in Portuguese) as shown in Figure B.2 (Appendix B). After concluding the activity, they were invited to answer an online questionnaire. This questionnaire and some of its results are shown in Appendix B. The following sections detail the guide evaluation. Following the evaluation and after the analysis of the trainees’ comments and suggestions, the guide evolved to its final version. The final version was used in the controlled experiment with Schoooools.

14.1.1 Participants

The gamification course had 12 trainees and 9 of them participated in the evaluation (2 male and 7 female). Participants’ ages range from 36 to 51 years old. The majority (44.4%) was teaching in higher education institutions, 22.2% were secondary level teachers and the same number were professional trainers. One participant was teaching at basic education level (11.1%). The participants did not have any prior experience in the development of gamified activities but intended to apply gamification in their classes.

14.1.2 Procedure

To evaluate the guide, the participants answered an online questionnaire (Appendix B). The questionnaire had three initial demographic questions (gender, age and teaching level) and eight closed questions using a five-point Likert scale (1 - “strongly disagree”, 2 - “disagree”, 3 - “neither agree nor disagree”, 4 - “agree”, 5 - “strongly agree”). The proposed questionnaire concluded with three final open questions. In these final questions, the participants were asked to provide feedback regarding their experience with the guide (what they liked best and what they think that could be improved) and they were invited to give their comments and suggestions. The questionnaire was set up with an online survey tool.
### 14.1.3 Survey’s Results

The results from the three initial questions can be seen in Appendix B. Question 4 had eight closed subquestions. In the first six subquestions the participants answered about their experience using the guide: if the guide was usefull to help them develop the gamified activity (question 4.1) and if the guide was adequate to their teaching or training activities (question 4.2). The following four subquestions asked the participants about the clarity of the guide steps (question 4.3), their sequence (question 4.4), the number of steps (question 4.5) and the steps names (question 4.6). The questionnaire’s results are detailed in Table 14.1.

All of the participants considered the guide usefull (88.9% answered “strongly agree”) and adequate to their activities. Concerning the guide steps, they all also agreed that their clarity, sequence, number, and names were adequate (all answers were “agree” and “strongly agree”).

In the last two subquestions the participants were asked if they considered that the guide had one or more unnecessary steps (question 4.7) and if they considered that one or more steps should be reformulated (question 4.8). The majority considered that there were no unnecessary steps (66.7%) and that the steps did not need a reformulation (55.6%).

#### Table 14.1: Gamification Guide Evaluation: Question 4

<table>
<thead>
<tr>
<th>Likert Scale</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question 4.1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1 (11.1%)</td>
<td>8 (88.9%)</td>
</tr>
<tr>
<td>Question 4.2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5 (55.6%)</td>
<td>4 (44.4%)</td>
</tr>
<tr>
<td>Question 4.3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3 (33.3%)</td>
<td>6 (66.7%)</td>
</tr>
<tr>
<td>Question 4.4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3 (33.3%)</td>
<td>6 (66.7%)</td>
</tr>
<tr>
<td>Question 4.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5 (55.6%)</td>
<td>4 (44.4%)</td>
</tr>
<tr>
<td>Question 4.6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4 (44.4%)</td>
<td>5 (55.6%)</td>
</tr>
<tr>
<td>Question 4.7</td>
<td>8 (66.7%)</td>
<td>1 (11.1%)</td>
<td>0</td>
<td>1 (11.1%)</td>
<td>1 (11.1%)</td>
</tr>
<tr>
<td>Question 4.8</td>
<td>5 (55.6%)</td>
<td>1 (11.1%)</td>
<td>1 (11.1%)</td>
<td>2 (22.2%)</td>
<td>0</td>
</tr>
</tbody>
</table>

### 14.1.4 Qualitative Analysis

In the last part of the questionnaire, the participants had the opportunity to provide additional feedback about their experience with the guide. Questions 5, 6 and 7 were open questions asking for comments and suggestions. The participants’ opinions are listed in detail in Appendix B. These opinions show that the guide was considered usefull and well structured by the majority of the participants. They also considered that the guide steps were clear and well defined. Some comments can be taken as examples: “clear presentation in the form of a diagram. Brief but effective descriptions” ("Apresentação
clara sob a forma de diagrama. Descrições sucintas mas eficazes.”) and “the logical sequence helped me to prepare the task” (“A sequência lógica me ajudou muito a elaborar a tarefa.”). About what could be improved in the guide, the participants mentioned that a better distinction (or a merge) between some of the steps could be made and also the need to clarify the differences between the players’ deliverables and the designer’s deliverables. After the analysis of the participants’ suggestions, some improvements were made. The deliverables from Steps 4 and 5 (Figure B.2) were merged and also the deliverables’ descriptions were revised.

14.2 Controlled Experiment with Schoooools

In order to assess the effectiveness of the proposed framework and to answer to the thesis second research question (does a gamified Social Learning Environment cause a higher students’ disposition to experience flow than a non-gamified Social Learning Environment?), an experiment was carried out to measure the effect of a gamified SLE in the engagement of its users (the players), students from a primary school. The overall purpose of the experiment was to test the hypothesis that a gamified version of a SLE causes in its users an increase in their disposition to experience flow than the non-gamified version, following the above research question. The disposition to experience flow was assessed by using the questionnaire based on the Portuguese version of the DFS-2 (Gouveia et al., 2012), like in the pilot test presented on the previous chapter. Schoooools (Chapter 12) was the SLE used in the experiment. At least, one similar experience is known (Abrantes and Gouveia, 2014) in which children with ages between five and seven years, answered a survey to determine the existence of the flow experience when playing educational games.

14.2.1 Experimental Design

The experiment was designed as a controlled experiment which is a research method that can be used as an empirical research method for software engineering (Easterbrook et al., 2008). In a controlled experiment, a testable hyphotesis is investigated and one or more independent variables are measured in order to find their effect on one or more dependent variables. The total score in the DFS-2 questionnaire was the experiment’s dependent variable. The experiment considered a single independent variable (or factor) with two levels: the gamified activities in Schoooools versus the non-gamified activities. In a controlled experiment, each of these two levels are called treatments. Since the subjects were not randomly assigned to the treatments (the whole class had each treatment) the experiment can be considered a quasi-experiment. This kind of experiment is also known
as a replicated experiment: “several treatments are formed that implement products using either the old or new task. Data is collected on both approaches, and the results are compared” (Zelkowitz and Wallace, 1998). The experiment has also some of the requirements of action research because the class teacher was involved in the definition and in the tuning of the experiment.

The experiment required human subjects (the students) to perform a task (using the SLE Schoooools). The subjects were basic education students from a Portuguese primary school (Section 14.2.3). The subjects used a non-gamified version of Schoooools to perform a set of activities and then they used the gamified version for similar activities. In between, they answered an adapted version of the DFS-2 questionnaire (see Appendix A). After they performed the activity in the gamified version, the subjects answered the questionnaire a second time. The experiment followed a one group pre-test and post-test design: one group of participants is pre-tested on the dependent variable and then post-tested after the treatment condition has been administered. In the end, the results were compared and the effect is taken to be the difference between the pre-test and the post-test scores (Stephens, 2006).

The experiment followed the model showed in Figure 2.2 from Chapter 2. This model is based on the framework for empirical flow studies and on the PAT model (Section 6.5.2). Regarding the flow factors in the flow framework, only the person-task interaction flow antecedents are considered. The task-artifact interaction, that states that there must be a fit between the demands of the technology and the demands of the task, is considered to exist. The SLE (the artefact) used in the experiment has been used with success so the task-artefact fit was assumed. The same goes for the person-artefact interaction. Students, the players in the gamified learning activity, are digital natives, as discussed in Chapter 3. Therefore, as they are considered to be familiar with technology use, the person-artefact fit was also assumed.

### 14.2.2 Threats to Validity

Validity is a control element in experimental studies. Validation threats are the factors and conditions that may distort the scientific evidence that supports the interpretation of the results. The conclusions drawn from the experiment must consider the threats that the chosen research method might impose.

According to Easterbrook et al. (2008), there are four criteria for validity:

- **Construct validity**, that concerns the correct measures and their interpretation regarding the theoretical constructs;
• **Internal validity**, that deals with the experiment’s design: do the results really follow from the data?

• **External validity**, that focuses on the generalization of the results;

• **Reliability**, that has to do with the experiment’s replication meaning, that if other researchers will get the same results with a similar experiment.

Regarding **construct validity**, a threat occurs if the measured variables do not correspond to the purposes of the experiment. The chosen independent variable, the DFS-2 total score, is valid measure for the experience of flow. This claim is supported by several research evidence that states DFS-2 as a proper flow measure, also adequate in gamification scenarios. Also, using flow to measure students’ engagement is considered a proper approach (Shernoff et al., 2014; Whitson and Consoli, 2009).

Some threats to **internal validity** were identified. The experiment’s design – one group pre-test and post-test – does not control for potentially confounding extraneous variables such as historical factors, maturation, testing effects, instrumentation, and statistical regression (Fortin, 2009). These are threats to the identification of the treatment condition effect. From those threats, only testing effects, instrumentation, and statistical regression were considered as threats in the experiment’s context. Testing effects mean that the subjects can get used to the test which may lead to bias. Answering the same questionnaire in the pre-test and in the post-test may lead to score gains. This threat was addressed by taking the questionnaire a second time several weeks after the pre-test to decrease the chances that subjects make comparisons with previous answers. Instrumentation or instrument change was considered because the subjects’ teacher helped them answering the questionnaire, by reading aloud (as recommended by DFS-2 authors when subjects’ ages are below twelve years old) and explaining some of the questions. This could affect the experiment since the teacher, unconsciously, could have changed the explanation criteria or use different judgements. This threat was addressed by asking the teacher to use the same criteria in the pre-test and in the post-test. The adequacy of the DFS-2 to the subjects’ ages was of concern. The teacher’s active presence, when the subjects were answering the questionnaires, was also a way to deal with this other potential threat. The teacher read and explained each question to the subjects to avoid misinterpretations. Statistical regression, or regression towards the mean may occur when subjects with extreme scores (very high or very low) are selected. In subsequent tests these subjects are likely to get closer to the mean. This threat was considered and two subjects with extreme scores in the pre-test were rejected.

In respect to **external validity**, some experiment’s design issues must be considered. The experiment’s design is considered as a pre-experimental design since it does not
include a control group. Only one single selected group was under observation and got the treatment. Also, subjects were not randomly assigned. The sample may not be a relevant sample from the population. Therefore, generalization of the results of this experiment is limited and must be carefully considered.

Concerning the experiment’s reliability, the results may be affected by the following variations:

- The teachers involved;
- The game elements and game techniques applied;
- The chosen SLE.

Regarding the first item, the threat is that different teachers may approach the experiment differently. The guide included in the framework also intends to avoid significant differences in the approach to gamify some activity. Hence, although the way each teacher may take the experiment can influence the results, a guide with a sequence of well-defined steps can reduce the variability due to different approaches, teaching methods or chosen activities.

Different sets of game elements and game techniques could lead to different results. However, the elements applied in GET7 are some of the most used and commonly found elements and techniques in existing gamified applications. The SLE used in the experiment was gamified using some of those elements and techniques. It is not expected to find other SLEs with significant differences in the set of applied game elements and game techniques.

### 14.2.3 Participants

The subjects in the experiment were 26 students from the 3rd grade Class 6 (academic year of 2014/2015) of Primary School Eng. Fernando Pinto de Oliveira in Northern Portugal. From these 26 students, 14 are girls (53.8%) and 12 are boys (46.2%). The majority of the students attended kindergarten. The class does not have students involved in special education programs. However, of the seven new members who joined the group for the first time, three were retained in the previous year. The class teacher major goal is to prepare students for the 4th grade, develop autonomy, accountability and team building, besides the obvious content acquisition according to curriculum. At the beginning of the academic year, there were five students with nine years of age, one was seven years old and the remaining were eight years old. The classroom had one
computer with Internet access. Most of the students, 22 (84.6%) had a computer at home and 23 (88.5%) had Internet access from home. Nevertheless, all students were considered to be able to access the Internet, in the classroom or outside the classroom. Regarding leisure activities, 18 students (69.2%) reported that they spend part of their free time playing video games. Television and other media were reported by 22 students. Other activities, like reading, were indicated by 16 students. The class had previous experience with Schoooools.

14.2.4 Procedure

The statistical inference procedure followed in the experiment was the test of hypothesis. The hypothesis, as stated before, was if a gamified version of a SLE would cause in its users an increase in their disposition to experience flow than the non-gamified version. The disposition to experience flow was measured, for each subject, as the DFS-2 total score. Hence, the experiment should test, as a research hypothesis, if the subjects’ average DFS-2 total score is higher with the gamified version of Schoooools than with the non-gamified version. The experiment used, as a statistical test, the t-distribution, also known as the Student-t distribution (Stephens, 2006). This test is suited for small sample sizes (less than 30). Since the samples are not independent (the same group in the pre-test and in the post-test), the samples were paired or matched. For each subject, the score differences between the post-test and the pre-test were computed. The mean of the sample differences was used to test the hypothesis concerning the mean of the population of all possible differences. In a test of hypothesis, the negation of the research hypothesis is called the null hypothesis. The null hypothesis assumes that there are no differences in the average total scores between the post-test and the pre-test. The test will conclude that the research hypothesis is true if evidence against the null hypothesis is found. Otherwise, the test will reject the research hypothesis. Following Stephens, the notation below will be used:

- \( \mu_d \): mean of the population of paired differences;
- \( \sigma_d \): standard deviation of the population of paired differences;
- \( \bar{d} \): mean of the sample paired differences;
- \( S_d \): standard deviation of the sample paired differences;
- \( n \): number of the sample paired differences;
- \( S_{\bar{d}} \): estimated standard error of \( \bar{d} \).
Therefore, the null hypothesis is formulated as

\[ H_0 : \mu_d = 0 \]

and the research or alternative hypothesis, \( H_a \), as

\[ H_a : \mu_d > 0 \]

For each subject, \( d \) is the difference between the total DFS-2 score in the post-test and the total DFS-2 score in the pre-test.

The sample mean of paired differences is computed as

\[ \bar{d} = \frac{\sum d}{n} \]  

(14.1)

and the sample standard deviation of paired differences as

\[ S_d = \sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{n}}{n - 1}} \]  

(14.2)

The estimated standard error of \( d \) is

\[ S_{\bar{d}} = \frac{S_d}{\sqrt{n}} \]  

(14.3)

Assuming that the population of differences is normally distributed, the statistic given in formula below has a t-distribution with \( n - 1 \) degrees of freedom:

\[ t = \frac{\bar{d} - \mu_d}{S_{\bar{d}}} \]  

(14.4)

To test the null hypothesis, \( \mu_d \) equals 0. The null hypothesis is rejected if the t-value obtained in the above formula is greater than a critical value. Critical values of t for the specified number of degrees of freedom \( (n - 1) \) with different levels of significance \( (\alpha) \) can be obtained from published tables (e.g. Stephens (2006)).

### 14.2.5 Running the Experiment

The setup of the experiment started with several interviews with the subjects’ teacher. The concept of gamification and how it could be used in learning settings was also
detailed. The flow concept was also presented and the lists of game elements and game techniques were provided to the teacher.

Subjects and subjects’ parents were given information about the experiment and the parents signed informed consent. The pre-test took place in March, 2015 and the post-test in May, 2015, with the participation of all of the 26 subjects. During the experiment, both in the pre-test and in the post-test, they accessed Schoooools mainly from home. Questionnaires were answered in the classroom where the subjects usually have their classes.

The teacher followed the guide shown in Table 11.1 in Chapter 12. The guide is depicted in Figure 14.1 and is a more refined version of the initial guide that was used in the survey described in Section 14.1. Steps 1 to 7 were followed according to Figure 14.1.

**Step 1: Activities and Context Characterization.**

Regarding the first step of the guide, the following questions were adressed:

- **What is the context nature?** The activities will take place in a digital context (the SLE Schoooools). The system itself will act as a mediator but since some of the gamification functionalities were not implemented, the teacher will also act as a mediator.

- **Who are the players?** Players’ characterization is provided in Section 14.2.3. In the teacher’s view, a collaborative approach for players’ interactions was chosen but also some competitive issues should be addressed.

- **Which are the target behaviors?** In the teacher’s opinion, students were not very active users of Schoooools and needed to improve their participation and be more engaged with the activities proposed in Schoooools.

- **Which are the target activities?** Following the above questions, the teacher choose the activities. The teacher received an informal description about what was intended with Step 1:

  > The teacher must choose a set of activities to be gamified. The activities must take place for a few hours or days. Each activity must be splitted in several tasks. Each activity is a mission in the gamified setting and each task is level within the mission. Each mission must have an overall goal and the mission’s levels must have intermediate goals concerning the mission’s goal. All goals must be quantified.

When the context was set, the procedure continued to following step.
Chapter 14. Experiment

Figure 14.1: Reference Guide to Apply Gamification.
Step 2: Define the Activities Goals.

In this step, the missions’ activities were defined and each one’s goal was set. Each mission’s overall goal was quantified.

- Activity 1: the player must choose a country and then identify the country’s capital in an activity created in the platform; the player should write a text related to the country, make a drawing of the country’s flag, and share a photo of the capital and a link about the country or its capital; the player must complete the activity, at least, once.

- Activity 2: the player must choose an animal and then create an activity in the platform in which the player should identify some of the animal’s features, write a poem or a short story about the animal, make a drawing, and share a picture and a link about the animal; the player must complete the activity, at least, once.

- Activity 3: the player must choose a book, read it, and then create an activity in the platform in which the player must fill the book’s title, book’s author, a summary of the plot, make a drawing about the book, and share a picture and a link about the book; the player must complete the activity, at least, once.

- Activity 4: the player must choose a sport and then create an activity in the platform in which the player should identify some of the sport’s features (name and a description), make a drawing, and share a picture and a link about the sport; the player must complete the activity, at least, once.

The initial set of activities and their goals can be seen in Figure 14.2 ("Atividade 1", "Atividade 2", "Atividade 3" and "Atividade 4"). After the missions were set with quantified goals, the game techniques were applied in Step 3.

Step 3: Apply the 7 Game Techniques.

In this step, after having set the missions’ goals, the designer should clarify how to apply the game techniques.

- Clear and intermediate goals: each mission’s activities were split in a set of intermediate tasks (six tasks). These tasks’ goals are the intermediate goals of the missions’ activities, described in the previous step.

- Content unlocking: players can access hidden content when completing a mission.

- Time pressure: some levels or missions will have a time limit to completion.
Atividades Schoooools

**Atividade 1: Um país, uma capital!**

- Nível 0 – Identificar a atividade (título no escolinhas) – 1 ponto
- Nível 1 – Identificar o nome do país e a capital (ferramenta de texto) – 1 ponto
- Nível 2 – Fazer um pequeno texto relacionado com o país (ferramenta de texto) – 4 pontos
- Nível 3 – Desenhar a bandeira do país (ferramenta de desenho) – 2 pontos
- Nível 4 – Introduzir uma imagem ou foto da capital (ferramenta de imagem) – 2 pontos
- Nível 5 – Partilhar um link com informação sobre o país ou capital (ferramenta de texto) – 2 pontos

**Atividade 2: Um animal, uma companhia!**

- Nível 0 – Identificar a atividade (título no escolinhas) – 1 ponto
- Nível 1 – Identificar o nome e a classe do animal (ferramenta de texto) – 1 ponto
- Nível 2 – Fazer um pequeno texto (poema ou história) sobre o animal (ferramenta de texto) – 4 pontos
- Nível 3 – Fazer um desenho sobre o animal (ferramenta de desenho) – 2 pontos
- Nível 4 – Introduzir uma imagem ou foto do animal (ferramenta de imagem) – 2 pontos
- Nível 5 – Partilhar um link com informação sobre o animal (ferramenta de texto) – 2 pontos

**Atividade 3: Um livrinho, uma história!**

- Nível 0 – Identificar a atividade (título no escolinhas) – 1 ponto
- Nível 1 – Identificar o título e o autor (ferramenta de texto) – 1 ponto
- Nível 2 – Fazer um pequeno resumo do livro (ferramenta de texto) – 4 pontos
- Nível 3 – Fazer um desenho sobre o livro (ferramenta de desenho) – 2 pontos
- Nível 4 – Introduzir uma imagem ou foto sobre o livro (ferramenta de imagem) – 2 pontos
- Nível 5 – Partilhar um link com informação sobre o autor (ferramenta de texto) – 2 pontos

**Atividade 4: Um desporto, um amigo!**

- Nível 0 – Identificar a atividade (título no escolinhas) – 1 ponto
- Nível 1 – Identificar o nome do desporto (ferramenta de texto) – 1 ponto
- Nível 2 – Fazer uma descrição do desporto (ferramenta de texto) – 4 pontos
- Nível 3 – Fazer um desenho sobre o desporto (ferramenta de desenho) – 2 pontos
- Nível 4 – Introduzir uma imagem ou foto onde se jogue esse desporto (ferramenta de imagem) – 2 pontos
- Nível 5 – Partilhar um link com informação sobre o desporto (ferramenta de texto) – 2 pontos

**Atividade 5: Um herói, muita imaginação!**

- Nível 0 – Identificar a atividade (título no escolinhas) – 1 ponto
- Nível 1 – Identificar o nome do herói (ferramenta de texto) – 1 ponto
- Nível 2 – Fazer uma descrição do herói (ferramenta de texto) – 4 pontos
- Nível 3 – Fazer um desenho sobre o herói (ferramenta de desenho) – 2 pontos
- Nível 4 – Introduzir uma imagem ou foto sobre o herói (ferramenta de imagem) – 2 pontos
- Nível 5 – Partilhar um link com informação sobre o herói (ferramenta de texto) – 2 pontos

**Atividade 6: Uma comida, uma delícia!!**

- Nível 0 – Identificar a atividade (título no escolinhas) – 1 ponto
- Nível 1 – Identificar o nome da "comidinha" (ferramenta de texto) – 1 ponto
- Nível 2 – Fazer uma descrição da "comidinha" (ferramenta de texto) – 4 pontos
- Nível 3 – Fazer um desenho sobre a "comidinha" (ferramenta de desenho) – 2 pontos
- Nível 4 – Introduzir uma imagem ou foto da "comidinha" (ferramenta de imagem) – 2 pontos
- Nível 5 – Partilhar um link com informação da "comidinha" (ferramenta de texto) – 2 pontos

---

**Figure 14.2:** Description of the Experiment’s Gamified Activities.
• Fun failure: if the player fails a level or mission, the player can start again, without any penalty.

• Multiple paths: there is no specific order to take the missions; in each mission, levels are numbered but the players can follow a different order.

• Social interactions: each player will share his/her achievements in the class wall (a Schoooools feature).

• Virtual economy: each player must have access to physical or real rewards. A game element should be used as virtual currency. The player can donate points to other students or to some class/school initiative.

After setting the game techniques, game elements were applied in Step 4.

Step 4: Apply the 7 Game Elements.

In this step, the designer must define how to use the game elements accordingly to the game techniques:

• Levels: a total of six levels for each activity was set; each level is a task within each activity; levels were numbered from 0 to 5 (Figure 14.2);

• Point Systems: for each completed level in an activity, the player earns points; these points are XP and are quantified in Table 14.2;

• Badges: At the end of each one of the three mission’s activities, the player earns a badge; the badge’s icon concerns each mission’s theme (see Figure 12.4 in Chapter 12);

• Leaderboards: A leaderboard was kept with each player’s total amount of XP;

• Virtual currency: XP were used as virtual currency;

• Social graphs: in Schoooools, each player is already connected (as a friend) with peers (students from the same class). In Schoooools, peers are automatically considered as friends.

The progress bar game element was not considered in the experience.

At the end of Step 4, a description of the missions and levels was produced, as a guide deliverable. This description is shown in Figure 14.2. The procedure continued to Step 5, to set the gamified activities rules.
Chapter 14. *Experiment*

Table 14.2: Experiment: Missions’ Points and Levels

<table>
<thead>
<tr>
<th>Level</th>
<th>Points (XP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
</tr>
</tbody>
</table>

In the teacher’s interviews before players use the gamified version of Schoooools, some rules were defined. These rules established what, how and when to use the game elements. Those rules are described in the following step and were formally described after game elements were set.

**Step 5: Set the rules.**

Informal description of the rules:

- When a mission ends, the player earns a badge;
- When the player finishes a mission’s level, the players earn XP (Table 14.2);
- When the player reaches 24 XP, the player gets a physical reward;
- When all the class reaches 900 XP, the all class gets a reward;
- A leaderboard (high performing peers) will be kept, ranking players by XP;
- When the activities end, the top 5 players in the leaderboard will get a physical reward.

Some other rules were considered to be applied as a teacher’s option:

- If a player finishes the same mission more than three times, the player receives a reward;
- Each player can donate XP to other players (social interaction; virtual economy);
- If a player helps another players, the player gets additional XP (social interaction; virtual economy);
- If the player finishes a mission, completing all the mission’s levels, the player can get hints (e.g. links shared by the teacher) for another mission (content unlocking);
• If a player writes a post the class blog, commenting other players’ actions, the player gets an additional reward (social interaction; virtual economy);

• The player can share badges and rankings in the players’ profile.

Since Schoooools does not have a proper gamification engine there was no need for a formal description of the rules. The teacher added additional work to manage and process gamification data in order to apply elements and techniques in a way that the above rules were met. Nevertheless, if a DSL like GaML (see Section 8.4.1) was applied, a possible formal description of a rule could be the following:

```plaintext
class Schoooools {
    point XP { name="pontos" }
    level level3 { name="Desenho sobre o animal" }
    mission Atividade2 {
        name="Um Animal, Uma Companhia"
        when player {
            did level3
        }
        then {
            give 2 XP
        }
    }
}
```

The above GaML definition links to the rule *when the player finishes a mission’s level, the player earns XP* (informal description). In the above example, the mission is “Atividade 2” (Figure 14.2). When a player finishes Level 3 (“Nível 3”) then the player earns 2 XP (“2 pontos”).

At the end of Step 5, the gamified activities were completely defined. The proposed activities could then be deployed.

**Step 6: Deploy the solution.**

From the teacher’s initial description, four activities were deployed (“Atividade 1” to “Atividade 4”). The students did also the other two activities (“Atividade 5” and “Atividade 6”) but after the experiment’s post-test. Students executed the activities as homework, mainly accessing the platform from their homes.

An example of the activities developed by students within the experiment can be found in Chapter 12: Figure 12.2, an example of “Atividade 1 - Um País, Uma Capital”.
Step 7: Evaluate the results.

At the end of all the procedure, the gamified activities were evaluated. According to the guide, the designer should evaluate if the target behaviors were observed. The interview with the teacher after the post-test, to analyse the results allowed to conclude that the class students increased their participation in the platform and were more motivated. The participation was not the same for every student with some students finishing more activities than others but the overall result was considered positive by the teacher. Therefore, in Step 7, the answer to the question the target behaviors were observed? was yes.

In the case of a no answer, the designer should then redefine the activity regarding a set of four questions. Although the answer was yes, those questions were discussed in the teacher’s interview:

- **Goals were clear?** It was considered by the teacher that the class understood the activities goals (the mission’s overall goals and the levels’ intermediate goals).

- **Feedback was immediate?** Feedback was not so immediate as it was intended to be. Students did the missions as homeworks and only in class they received feedback for their actions. Besides the time delay, during the experiment’s run time period, schools’s Internet access was not always available.

- **Players were in control?** The teacher observed that his students were more motivated and felt more confident performing the activities, knowing exactly what to do, therefore with more control on how they were performing.

- **Missions and levels were balanced with the players’ skills?** Since the activities were chosen by the teacher, almost in the end of the academic year, the activities were perfectly balanced with the student’s skills and experience with the platform. The mission’s levels were designed to have an increasing difficulty level to cope with the students increasing experience using Schoooools.

14.2.6 Experiment’s Results

At the end of the experiment, after Step 7 from the guide, the students answered the questionnaire and then the scores were processed, according to the DFS-2 manual (Jackson et al., 2010), and analysed. The results were processed following the same procedure used on the pilot-test (Section 14.1.4). The pre-test scores for all the class are shown on Table 14.3 and the post-test score on Table 14.4. Two of the subjects were discarded, concerning the statistical regression internal validity threat, as seen in Section
These two subjects’ questionnaires in the pre-test were not considered reliable. Therefore, 24 pairs of scores were processed.

<table>
<thead>
<tr>
<th>DFS-2 Dimensions</th>
<th>Items</th>
<th>Total Scores</th>
<th>Item-Average Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1. Challenge-Skill Balance</td>
<td>Q1+Q10+Q19+Q28</td>
<td>16.92</td>
<td>4.23</td>
</tr>
<tr>
<td>D2. Merging of Action and Awareness</td>
<td>Q2+Q11+Q20+Q29</td>
<td>12.25</td>
<td>3.06</td>
</tr>
<tr>
<td>D3. Clear Goals</td>
<td>Q3+Q12+Q21+Q30</td>
<td>17.96</td>
<td>4.49</td>
</tr>
<tr>
<td>D4. Unambiguous Feedback</td>
<td>Q4+Q13+Q22+Q31</td>
<td>17.13</td>
<td>4.28</td>
</tr>
<tr>
<td>D5. Concentration on the Task at Hand</td>
<td>Q5+Q14+Q23+Q32</td>
<td>17.63</td>
<td>4.41</td>
</tr>
<tr>
<td>D6. Sense of Control</td>
<td>Q6+Q15+Q24+Q33</td>
<td>17.83</td>
<td>4.46</td>
</tr>
<tr>
<td>D7. Loss of Self-Consciousness</td>
<td>Q7+Q16+Q25+Q34</td>
<td>14.51</td>
<td>3.64</td>
</tr>
<tr>
<td>D8. Transformation of Time</td>
<td>Q8+Q17+Q26+Q35</td>
<td>14.63</td>
<td>3.66</td>
</tr>
<tr>
<td>D9. Autotelic Experience</td>
<td>Q9+Q18+Q27+Q36</td>
<td>18.04</td>
<td>4.51</td>
</tr>
<tr>
<td>Total Scale Score (sum column D)</td>
<td></td>
<td>36.73</td>
<td></td>
</tr>
</tbody>
</table>

The mean value of the subjects’ total score was 36.73 (with a standard deviation of 3.70). The higher score was obtained in the D9 dimension (autotelic experience) and the lowest on the D2 dimension (merging of action and awareness).

<table>
<thead>
<tr>
<th>DFS-2 Dimensions</th>
<th>Items</th>
<th>Total Scores</th>
<th>Item-Average Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1. Challenge-Skill Balance</td>
<td>Q1+Q10+Q19+Q28</td>
<td>16.96</td>
<td>4.23</td>
</tr>
<tr>
<td>D2. Merging of Action and Awareness</td>
<td>Q2+Q11+Q20+Q29</td>
<td>15.46</td>
<td>3.86</td>
</tr>
<tr>
<td>D3. Clear Goals</td>
<td>Q3+Q12+Q21+Q30</td>
<td>18.33</td>
<td>4.58</td>
</tr>
<tr>
<td>D4. Unambiguous Feedback</td>
<td>Q4+Q13+Q22+Q31</td>
<td>16.21</td>
<td>4.05</td>
</tr>
<tr>
<td>D5. Concentration on the Task at Hand</td>
<td>Q5+Q14+Q23+Q32</td>
<td>17.67</td>
<td>4.42</td>
</tr>
<tr>
<td>D6. Sense of Control</td>
<td>Q6+Q15+Q24+Q33</td>
<td>17.38</td>
<td>4.34</td>
</tr>
<tr>
<td>D7. Loss of Self-Consciousness</td>
<td>Q7+Q16+Q25+Q34</td>
<td>16.04</td>
<td>4.01</td>
</tr>
<tr>
<td>D8. Transformation of Time</td>
<td>Q8+Q17+Q26+Q35</td>
<td>15.58</td>
<td>3.90</td>
</tr>
<tr>
<td>D9. Autotelic Experience</td>
<td>Q9+Q18+Q27+Q36</td>
<td>17.79</td>
<td>4.45</td>
</tr>
<tr>
<td>Total Scale Score (sum column D)</td>
<td></td>
<td>37.85</td>
<td></td>
</tr>
</tbody>
</table>

In the post-test, the mean value of the subjects’ total score was 37.85 (with a standard deviation of 3.84). The higher score was obtained in the D3 dimension and the lowest on the D2 dimension, like in the pre-test. The boxplots of the pre-test and the post-test are shown in Figure 14.3. The post-test median (38.38) was slightly higher than the pre-test median (37.50). The post-test lower quartile was also higher than the one found in the pre-test.

The paired differences between the total DFS-2 scores, for each subject, are shown in Table 14.5.
Table 14.5: DFS-2 Total Scores: Paired Differences.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Difference</th>
<th>Subject</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-1.75</td>
<td>13</td>
<td>-3.50</td>
</tr>
<tr>
<td>2</td>
<td>0.75</td>
<td>14</td>
<td>3.50</td>
</tr>
<tr>
<td>3</td>
<td>-3.75</td>
<td>15</td>
<td>3.00</td>
</tr>
<tr>
<td>4</td>
<td>3.00</td>
<td>16</td>
<td>-2.25</td>
</tr>
<tr>
<td>5</td>
<td>1.25</td>
<td>17</td>
<td>-1.50</td>
</tr>
<tr>
<td>6</td>
<td>7.00</td>
<td>18</td>
<td>0.75</td>
</tr>
<tr>
<td>7</td>
<td>4.75</td>
<td>19</td>
<td>-1.75</td>
</tr>
<tr>
<td>8</td>
<td>0.50</td>
<td>20</td>
<td>2.25</td>
</tr>
<tr>
<td>9</td>
<td>1.25</td>
<td>21</td>
<td>2.00</td>
</tr>
<tr>
<td>10</td>
<td>12.00</td>
<td>22</td>
<td>-1.25</td>
</tr>
<tr>
<td>11</td>
<td>2.00</td>
<td>23</td>
<td>-1.75</td>
</tr>
<tr>
<td>12</td>
<td>-1.25</td>
<td>24</td>
<td>1.75</td>
</tr>
</tbody>
</table>

From the data in Table 14.5 the mean and standard deviation were computed. The obtained value for $\bar{d}$ was 1.13 (14.1). The value for $S_d$ was 3.50, obtained with formula (14.2). The test value, $t$, was calculated with formula (14.4) and was equal to 1.57. From t-test tables, a critical value of 1.32 was used ($df = 23$, $\alpha = 0.10$). The t-value was higher than the critical value. Table 14.6 summarizes the experiment main parameters and results.

Figures 14.4 and 14.5 show the boxplots for each flow dimension in the pre-test and in the post-test. Figure 14.4 considers the flow antecedents, the conditions required for reaching flow (challenge/skill balance, clear goals, sense of control, and unambiguous feedback). Figure 14.5 shows the boxplots for the flow outcomes (loss of self-consciousness, time
distortion, merging of action and awareness, concentration on the task at hand, and autotelic experience).

### 14.2.7 Discussion

The results’ analysis showed a slight increase in the class total average score (+1.13). Subjects have high scores in the pre-test (36.73), compared to the scores obtained in the pilot-test (35.35), described in Section 13.5, that were assumed as scores from a high disposition to experience flow (the maximum possible value for the DFS-2 total score is 45). With such high scores in the pre-test it was not expected a very high increase in the class score as the results revealed. Although two subjects’ scores were rejected due to statistical regression, this threat probably still affected the results and may help explain the small average increase. Also the intrumentation threat may have affected the results. It is admissible that in the post-test the teacher provided better explanations of each question.

Despite the slight increase, it is possible to conclude that the class, in average, showed a higher disposition to experience flow with the gamified version of Schoooools (Figure 14.3).

It is important to notice that some subjects (nine) had lower scores in the post-test (Table 14.5). Other subjects had significantly higher results in the post-test. A possible explanation may come from the teacher’s perception that the students had different levels of participation. The highest results may come from the students with higher levels of involvement. A more detailed analysis regarding the nine flow dimensions, considering the flow antecedents (Figure 14.4) and the flow outcomes (Figure 14.5) reveals that regarding flow antecedents, there was a decrease in the median of three dimensions. Only the challenge/skill balance median increased, which is a significant result since this antecedent is one of the GET7’s core concepts. It can be understood that subjects reported a higher balance between the challenges and their skills with the SLE gamified

<table>
<thead>
<tr>
<th>Table 14.6: Experiment’s Parameters and Results.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of subjects:  26</td>
</tr>
<tr>
<td>Number of considered questionnaires, ( n ): 24</td>
</tr>
<tr>
<td>Mean of sample paired differences, ( \bar{d} ): 1.13</td>
</tr>
<tr>
<td>Standard deviation of sample paired differences, ( S_d ): 3.50</td>
</tr>
<tr>
<td>Estimated standard error, ( S_{\bar{d}} ): 0.71</td>
</tr>
<tr>
<td>Test value, ( t ): 1.57</td>
</tr>
<tr>
<td>Critical value (from t-student’s tables): 1.32</td>
</tr>
<tr>
<td>Degrees of freedom (( df )): 23</td>
</tr>
<tr>
<td>Significance level (( \alpha )): 0.10</td>
</tr>
</tbody>
</table>
With respect to the dimensions related to flow outcomes (Figure 14.5), the median in the post-test was higher or equal (in D9 dimension) than the median obtained in the pre-test. These results are significant because these dimensions are considered as the outcomes of reaching flow. The results reveal that the subjects seemed to have a higher tendency to experience flow with the SLE gamified version. Particularly, the D2 dimensions (merging of action and awareness) had a significant increase.

The statistical test aimed to find if the differences between the total average scores in the post-test and in the pre-test were due to chance or if the results could be considered statistically significant. The obtained value for the test of 1.57 is higher than the critical value of 1.32 ($\alpha = 0.10, df = 23$). With these results it was possible to reject the null
Figure 14.5: Boxplots of Paired Flow Dimensions: Flow Outcomes.
hypothesis \((H_0)\) and therefore, to accept the research hypothesis \((H_a)\) as true with a significance level of 90.00%.

The experiment has several limitations to generalization (Section 14.2.2) but it was possible to conclude that the class had a statistically significant increase, although small, in the students tendency to experience flow while using the gamified version of Schooolool.

### 14.3 Summary

This chapter described the results from two different assessments: a survey on the use of the GET7 guide and a controlled experiment to evaluate the whole framework.

The survey targeted a set of subjects acting as gamification designers using the GET7 framework’s guide. The survey revealed that the respondents considered the guide useful and well structured. Some minor changes were made in the initial definition of the guide and a final version was used in the experiment.

The controlled experiment tested a group of subjects (a class of 3rd grade students) before and after the treatment (using the gamified version of Schooolool). A pre-test, using the DFS-2, indicated how the subjects did prior to administration of the treatment condition and a post-test evaluated the subjects after the treatment. The effect was taken as the difference between the pre-test and the post-test scores. The experiment had some limitations to generalization but it was possible to conclude that the class had a statistically significant increase, although small, in the students’ tendency to experience flow while using the gamified version of Schooolool. These results allowed to accept the research hypothesis: a gamified version of a SLE caused in its users an increase in their disposition to experience flow than the non-gamified version.
Part V

Conclusions
Chapter 15

Conclusions and Future Work

This chapter presents a summary of the main contribution made by the research work documented in this thesis. The final conclusions are presented along with how the thesis statement was addressed and how the obtained results met that statement. The chapter discusses the empirical results of this thesis with respect to the thesis statement and offers interpretations and conclusions based on those findings. The chapter also points for possible future lines of investigation and concludes with some hints about the future of gamification.

15.1 Final Conclusions

From the perspective of the gamification’s theoretical foundations, the main result is the contribution with a workable framework, which guides and supports gamified applications designers on the overall process of developing gamified applications. An architecture with the main building blocks for a gamified application was also considered, as part of the framework. The guide to help a teacher or a trainer to set up a gamified learning activity was another main contribution. The guide can be seen as a roadmap to setup a gamified learning activity. The guide was tested with a group of teachers and professional trainers and the test allowed to improve the guide to a final version used in the thesis’ experiment. The framework was primarily targeted for education, regarding the research problem, but is not exclusive to this context. This thesis investigated the problem of how a new trend, known as gamification, could be used to improve students’ motivation and engagement within a Social Learning Environment. The problem was addressed by proposing a framework for an effective and systematic application of gamification. This framework (GET7 - 7 Game Elements and 7 Game Techniques) includes a set of game elements and game techniques based on some core concepts. The core
concepts are intended to be the theoretical foundations of the framework and map the most important concepts from main psychological theories that have been supporting gamification studies.

This research work looked at several gamified applications, in educational and non-educational contexts, to find which game elements are used and how they are used. This preliminary work showed that, although some proposals for gamification frameworks are known, there is not any commonly accepted framework or set of guidelines to develop gamified applications neither an architecture defining the components and building blocks of such applications. Mostly, these proposals are step-by-step guides, based on simple observations of the existing applications, without considerations about the structure of the systems’ architectures. Some of them are specific to a certain kind of applications or to a particular non-game context. It is not known any scientific validation for most of these frameworks and methodologies. Hence, much of the work on gamification frameworks has focused more on ways and guidelines to apply gamification and to help designers quickly learn how to deploy an application, and less on defining a reference architecture for gamified applications.

Therefore, GET7 also includes a reference architecture with the main building blocks that should be considered in the development of a gamified system. The reference architecture for the proposed framework is platform independent and does not address implementation details. Finally, like some of the other known gamification frameworks’ proposals, GET7 also includes a guide on how to deploy gamified activities using a platform based on the proposed architecture.

The experiment conducted in this thesis allowed to validate the thesis statement: the use of a social gamification approach in a Social Learning Environment (SLE), applying good learning principles found in good games and supported by a proper framework, can foster students’ motivation and engagement by increasing their tendency to experience flow. Although small, an increase in the students’ tendency to experience flow was observed, particularly in the flow dimensions related to flow outcomes. However, these results generalization should be carefully considered. The research hypothesis was accepted but with a relatively small significance level.

To increase the statistical validity of the results, similar kind of experiments must be performed. Increasing the number of participants, using two different groups of subjects (an experimental and a control group), and randomly assign the subjects to each group would improve the experiment. However, in the conducted experiment and regarding pedagogical issues, it was not considered as adequate to split the same class in two different groups. Also, both groups would have a small number of subjects. The two groups
approach could be used by including two different classes, one class as an experimental group and the other class as the control group. But, in the school using the experiment’s SLE, there was only one 3rd grade class using Schooolools. Is was considered that only one teacher should be involved in the experiment. Having chosen classes from different schools would have also invalidated the one teacher requisite.

The research goals were achieved and the research questions were answered. For the first question – what is an effective way to use social gamification to improve students’ engagement in a Social Learning Environment? – it was found that the social gamification approach, where game elements are not just seen as rewards but as means to improve users’ intrinsic motivation and to increase their tendency to experience flow, could be applied by setting a proper framework. GET7 is based in a set of core concepts that use game elements and game techniques effectively. For the second question – does a gamified Social Learning Environment cause a higher students’ disposition to experience flow than a non-gamified Social Learning Environment? – the conducted experiment found gamified activities in a SLE, inspired by the proposed framework increased users tendency to experience flow.

From the results presented in this thesis, it can be concluded that gamification applied in a technology-enhanced learning environment, supported by the proposed framework, can make a contribution to students’ engagement and motivation.

15.2 Topics for Future Research

The experiment allowed to accept the research hypothesis but the statistical test has a low power (a significance level of 90% is considered low). There were also some identified threats to the experiment’s validity. Therefore, new experiments using the proposed framework with the same or other tools and SLE is a possible future line of research. Increasing the number of participants, using two different groups of subjects and randomly assign the subjects to each group are issues to consider in future experiences. The research should also benefit from experiments targeting other educational levels and different types of participants.

This research revealed that the application of gamification has many different issues to consider, ranging from technical aspects related with game design and game development to psychology theories related to motivation and behavior change. The research uncovered other topics for further research:
• Player types: a possible area for research concerns the different players types and how the framework could address those differences. Since users have different profiles, customisation and personalisation of the frameworks features are interesting issues to explore by future research.

• Narrative and storytelling: another area for possible future research is to explore an important game’s feature, the narrative, and investigate the power of storytelling in non-game contexts.

• A DSL for rules: a Domain Specific Language for rules is another promising line for future research. Developing a DSL closer to gamification platform’s users with no technical background but powerful enough to express the rules that implement game techniques and game elements would certainly bring an important contribution in gamified systems development.

• Development of Platform Specific Models: following the Model Driven Architecture approach, defining Platform Specific Models (PSM) and implementing platforms entirely built from the GET7 architecture is an obvious field for future research and development. Defining PSM’s will also allow for further improvements in the PIM model proposed in GET7 and further validate the approach.

15.3 The Future of Gamification

Gamification is becoming an IT phenomenon, with some arguing it is a meaningless buzzword that will soon fade away, while others argue it will revolutionize information technology in the same way as social networks. In the future, gamification will probably be somewhere in between these two extreme visions. Some of the today digital technology trends like mobile and wearable computing, BYOD (Bring Your Own Device), the Internet of Things or Big Data, that provides engagement metrics and behavior analytics, offer a huge potential to apply gamification principles. Some forecasts point to a 68% increase in the global gamification market from 2013 to 2018\(^1\) (although, it is hard to define what is the “global gamification market”). On the other hand, a study involving technology experts (Anderson and Rainie, 2012) revealed that 42% of them believed that by 2020, there will be no significant advances in the adoption and use of gamification.

These mixed expectations can be explained because gamification is a relatively new field, now at the “trough of disillusionment” in the Gartner Hype Cycle. The term is known for exactly five years considering that it started to be searched in Google in

\(^1\)http://www.crowdster.com/category/nullam-sed/gamification-market-statistics/9589
August, 2010. The initial optimism about how it would change business, healthcare, education and other areas where digital technologies and information systems play an increasing important role, is far from the present reality. Still, it is expected that in the near future more and more applications will apply some of the principles that guided gamification studies in the past few years. Concerning education and training, initiatives like Open Badges that provide the opportunity to create personal records of achievements, make them visible and certified, is somehow a sign of the gamification success. Badges are one of the most visible and popular gamification features and are a way to blend formal and informal education, acknowledging learning that happens in and out of formal institutions, as pointed by Johnson et al. (2015). This and other games features will most likely be part of many technology-enhanced learning platforms. Even today, some of these platforms are already available, waiting for a more widespread use. Other well-known and heavily used platfforms, like Moodle, also started to include some gamification features. Even if gamification will have limitated application in some areas, education and training are still considered as fields for high gamification growth.

Despite the concept’s potencial and how it will evolve in the next years, the term itself may disapear in the near future or be replaced by other more consensual one. But if this will happen, it will not mean that gamification underlying principles will vanish. The ability of these principles to engage and motivate will, most likely, make information system’s developers to adopt them to an extent that those principles will naturally be part of future information systems.
Appendix A

Flow State Scales

“Most people would agree that being in flow is a great experience, but:

- How do we know when someone is experiencing flow, and what is it like when they are in this state?
- To what extent are your athletes/students/employees/performers absorbed in, and enjoying, what they are doing?

The Flow Scales can provide answers to questions such as these. The Flow Scales assess the optimal psychological experience of flow – an experience involving total absorption in the task at hand. When in flow, one acts with confidence and ease, and usually at superior levels of performance. The Flow Scales have been used in a wide range of performance settings. We have developed a suite of scales – the Long, Short, and Core Flow Scales – providing a range of instrumentation to suit a diversity of research and applied purposes including in:

- Performance domains, such as sport, music, arts
- Work settings
- Free time activities and hobbies
- School settings.”

To whom it may concern,

This letter is to grant permission for the above named person to use the following copyright material for his/her thesis or dissertation research:

**Flow Scales:**
- LONG Dispositional Flow Scale - Physical (DFS-2 - Physical), Copyright © 1996, 2001 by S.A. Jackson. All rights reserved in all media.
- LONG Dispositional Flow Scale - General (DFS-2 - General), Copyright © 2009 by S.A. Jackson. All rights reserved in all media.
- LONG Flow State Scale - Physical (FSS-2 - Physical), Copyright © 1996, 2001 by S.A. Jackson. All rights reserved in all media.
- LONG Flow State Scale - General (FSS-2 - General), Copyright © 2009 by S.A. Jackson. All rights reserved in all media.
- SHORT Dispositional Flow Scale (S DFS-2), Copyright © 2002, 2009 by S.A. Jackson. All rights reserved in all media.
- SHORT Flow State Scale (S FSS-2), Copyright © 2002, 2009 by S.A. Jackson. All rights reserved in all media.
- CORE Dispositional Flow Scale (C DFS-2), Copyright © 2006, 2009 by S.A. Jackson and A. J. Martin. All rights reserved in all media.
- CORE Flow State Scale (C FSS-2), Copyright © 2006, 2009 by S.A. Jackson and A. J. Martin. All rights reserved in all media.

Five sample items in total may be reproduced for inclusion in a proposal, thesis, or dissertation.

The entire instrument may not be included or reproduced at any time in any other published material.

Sincerely,

Robert Most  
Mind Garden, Inc.  
www.mindgarden.com

---

**Figure A.1:** Grant Permission for DFS-2 Use.
Due to copyright restrictions (Figure A.1) only five items of the flow scales are shown (Figures A.2 and A.3).

### Appendix A. Flow State Scales

<table>
<thead>
<tr>
<th>When participating in:</th>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Frequently</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name Event/Activity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 I am challenged, but I believe my skills will allow me to meet the challenge</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2 I do things correctly without thinking about trying to do so</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3 I know clearly what I want to do</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4 It is really clear to me how I am doing</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5 My attention is focused entirely on what I am doing</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**Figure A.2:** DFS-2 Original Version - Five Sample Items.

Por favor responda às seguintes afirmações relacionadas com os pensamentos e emoções que pode sentir durante a prática da atividade escolhida. Pode experienciar estas características às vezes, sempre ou nunca. Não há respostas certas ou erradas. Pense na frequência com que habitualmente experimenta cada uma das afirmações seguintes quando pratica essa atividade e responda às questões usando a escala de avaliação fornecida. Faça um círculo no número que melhor corresponde à sua experiência.

Utilize a seguinte escala de avaliação:

1. Nunca
2. Raramente
3. Às vezes
4. Frequentemente
5. Sempre

**Quando particio em/Quando pratico:**

<table>
<thead>
<tr>
<th>Indique a Atividade:</th>
<th>Nunca</th>
<th>Raramente</th>
<th>Às vezes</th>
<th>Frequentemente</th>
<th>Sempre</th>
</tr>
</thead>
</table>

1. Sinto-me desafiado(a) mas acredito que as minhas capacidades estão à altura das exigências da situação | 1 | 2 | 3 | 4 | 5 |
2. Executo os movimentos corretamente sem pensar neles | 1 | 2 | 3 | 4 | 5 |
3. Eu sei claramente o que quero fazer | 1 | 2 | 3 | 4 | 5 |
4. Tenho uma percepção clara de como está a ser o meu desempenho | 1 | 2 | 3 | 4 | 5 |
5. Estou totalmente concentrado(a)/focado(a) naquilo que estou a fazer | 1 | 2 | 3 | 4 | 5 |

**Figure A.3:** DFS-2 Portuguese Version - Five Sample Items.
Appendix B

Gamification Guide Survey

The gamification guide survey was built with the SurveyMonkey web tool and is available at https://pt.surveymonkey.com/s/HHF6FC5.
FIGURE B.1: Questionnaire for GET7 Guide Evaluation.
Appendix B. Gamification Guide Survey

Results

Question 1:

![Figure B.3: Respondents Gender.](image)

Question 2: The participants’ average age was 43.4 years.

Question 3:

![Figure B.4: Respondents Teaching Level.](image)
Questions 5, 6 and 7:

In question 5, about what the participants liked best about the guide (“Indique o que considerou mais positivo no guia”), they answered:

- Participant 1: “Estrutura”
- Participant 2: “A estruturação”
- Participant 3: “Muito boa apresentação visual de todos os passos a serem tidos em conta como um percurso, como um caminho a trilhar, com indicação de quando seguir em frente, para o passo seguinte, e de quando voltar atrás, para refazer um ou outro passo.”
- Participant 4: “A distinção que faz das diferentes fases.”
- Participant 5: “Apresentação clara sob a forma de diagrama. Descrições sucintas mas eficazes.”
- Participant 6: “O facto de usar uma linguagem clara e sucinta.”
- Participant 7: “Fases bem definidas.”
- Participant 8: “A obrigatoriedade de correr todos os passos com uma determinada ordem, sem poder ‘saltar’ nenhuma. A clareza também foi um aspeto positivo.”
- Participant 9: “A sequência lógica me ajudou muito a elaborar a tarefa.”

In question 6, when asked about what could be improved in the guide (“Indique o que considera que poderia ser melhorado no guia”), their answers were:

- Participant 1: “Operacionalização, talvez com exemplos.”
- Participant 2: “Os conteúdos a serem descritos segundo a perspetiva do utilizador (jogador) e segundo a perspetiva do designer (sobretudo no passo 3) poderiam conter algumas indicações mais concretas relativamente a como estabelecer essa diferença (tal como foi feito relativamente ao passo 5, nos comentários apresentados).”
- Participant 3: “a ordem dos passos, é sequencial, quando o processo não é linear, é complexo, é integrado.”
- Participant 4: “Eventualmente incluir exemplos de técnicas e elementos de jogos (muito poucos, para não comprometer as descrições sucintas que referi no ponto 5.”
• Participant 5: “No passo cinco, não é clara a diferença entre o que é a definição (é o ponto de vista do designer?) e a descrição (é o ponto de vista do jogador?) das regras. Como aparece primeiro descrição... a definição devia anteceder a descrição.”

• Participant 6: “Descrição da informação a ser considerada para o designer.”

• Participant 7: “tive dificuldade de separar o passo 5 dos passos 3 e 4, mas não sei como isso poderia ser melhorado.”

Finally, in question 7, asking for comments and suggestions – “Outros comentários ou sugestões (p.e. passos a acrescentar/retirar; existência de redundâncias/sobreposições de passos, etc)” – the participants share the following opinions:

• Participant 1: “Talvez agregar a aplicação das técnicas de jogos (para o jogador) com a descrição das regras (para o jogador), ficando o passo 5 apenas com as regras formais para o designer.”

• Participant 2: “Nada a acrescentar. Excelente trabalho, sem dúvida!”

• Participant 3: “Talvez, nas definições das regras primeiro pensar nas regras para o designer, e depois as regras para o jogador.”
Appendix C

List of Publications

The work presented in this thesis is, in part, disseminated in several published papers. Some of the thesis contributions have been critically evaluated through the following published outputs:


Appendix D

Resumen

Visión General

Esta tesis aborda el problema del compromiso de los estudiantes mediante la investigación de si la gamificación puede contribuir a resolver el problema y cómo. La motivación y el compromiso son aspectos críticos para la realización de una tarea y el fomento de un comportamiento específico, por lo tanto, también son aspectos críticos para el éxito estudiantil.

La falta de compromiso de los estudiantes es un problema a nivel mundial en la mayoría de los países desarrollados. Recientes investigaciones apuntan a un 20% al 25% de los estudiantes de 28 países de la OCDE (Organización para la Cooperación Económica y el Desarrollo) clasificados como de baja participación y/o de un bajo sentido de pertenencia. El abandono escolar se da en todos los niveles educativos. La educación se enfrenta a la crisis de compromiso. El aburrimiento y la apatía en clase han sido apuntados como las principales razones por las que muchos estudiantes no se involucran en el aprendizaje. Estas razones conducen al abandono, al fracaso escolar, al bajo rendimiento y al absentismo. Sin embargo, mientras que las escuelas están luchando contra la falta de motivación y el compromiso de muchos de sus estudiantes, la tecnología es parte de las vidas de la mayoría de los niños y adolescentes de las sociedades actuales. Son grandes consumidores de medios de comunicación que, mediante los teléfonos móviles y las tecnologías inalámbricas, están casi permanentemente presentes y disponibles dondequiera. De hecho, las escuelas tienen que competir por la atención y el tiempo de los estudiantes, y así encontrar la forma de que utilicen la tecnología a su favor para llenar el hueco entre ellas y el mundo tecnológico exterior.

Esta falta de compromiso puede deberse al hecho de que los estudiantes actuales se distraen con la tecnología de los “smartphones” y de Internet. Pero las tecnologías digitales
Resumen

son parte de la vida de muchas personas, desde la más tierna infancia. Esto choca con la realidad de las aulas en las que la brecha tecnológica con el mundo exterior es cada vez mayor, haciendo del aula un lugar pasado de moda para los estudiantes acostumbrados a convivir con la tecnología. Los educadores no ignoran este hecho y la realidad es que las Tecnologías de la Información y Comunicación (TIC) se vienen utilizando en educación desde hace varios años con diferentes enfoques, incluyendo el uso de juegos con fines de aprendizaje. Sin embargo, los educadores aún están buscando las mejores estrategias de aprendizaje para enseñar con tecnologías digitales. La enseñanza con la tecnología no ha resuelto completamente el problema del compromiso y las escuelas aún están afrontando las dificultades relativas a la motivación y al compromiso. Además, los sistemas de e-learning no tuvieron el impacto esperado por muchos.

La gamificación es una nueva tendencia dirigida a incrementar el compromiso, la motivación, la lealtad o la participación de los que tienen que llevar a cabo cualquier actividad. Este concepto comenzó a ser utilizado inicialmente como una herramienta de marketing, pero se extendió a diferentes áreas en las que el compromiso de los participantes es una pieza clave. La gamificación está inspirada en el éxito y la popularidad de los videojuegos e intenta averiguar cómo utilizar componentes de los juegos en contextos que no sean lúdicos, como vía para manejar el compromiso de los participantes. De esta forma la gamificación permitiría sacar provecho del poder de los videojuegos con costes y esfuerzos menores. La investigación inicial sobre la gamificación revela que la educación es precisamente uno de los campos principales que se podrían beneficiar de esta nueva tendencia.

Por lo tanto, así como la gamificación pretende cambiar el comportamiento y aumentar la participación y las escuelas se enfrentan a una crisis de compromiso, a pesar de todos los esfuerzos realizados en la utilización de las TIC, la gamificación puede ayudar a hacer frente a esta crisis. En la investigación que condujo a esta tesis, surgieron algunas cuestiones iniciales: ¿cómo aplicar gamificación en contextos de aprendizaje con soporte tecnológico? y ¿cómo puede la gamificación ayudar a educadores y escuelas para que los estudiantes se comprometan más?

Como objetivo principal, la tesis propone un framework para ayudar a los profesores a utilizar entornos tecnológicos enriquecidos con gamificación. Se espera que estos entornos “gamificados” mejoren el comportamiento de los estudiantes hacia la escuela y el aprendizaje. El framework también define una arquitectura de alto nivel para sistemas digitales gamificados. Esta arquitectura es independiente de la plataforma y se propone como una manera de ayudar a los desarrolladores en la implementación de sistemas gamificados, poniendo de relieve lo que deben ser sus principales bloques de construcción.
Como parte importante de este trabajo se plantea cómo evaluar el impacto de la gamificación en entornos educativos. Para ello se eligió trabajar con el flujo, o flow, como medida del compromiso del estudiante con proceso de aprendizaje. Se define el flujo, o flow, como un estado psicológico que experimentan las personas cuando actúan con total compromiso. La tesis aborda este tema mediante el estudio empírico con jóvenes estudiantes de educación primaria. El estudio investigó si un Entorno Social de Aprendizaje con herramientas gamificadas sería capaz de aumentar la disposición de los estudiantes para experimentar el flujo, en comparación con una versión no gamificada. Los resultados del estudio empírico mostraron que hubo una mejora en la disposición de los estudiantes para el flujo cuando se utilizó la versión gamificada del Entorno Social de Aprendizaje. La puntuación media de los estudiantes se incrementó y la prueba estadística realizada permitió concluir que el incremento medio de los resultados era estadísticamente significativo.

El Contexto de la Investigación

Los estudiantes de hoy pertenecen a una generación comúnmente conocida como “nativos digitales” o como la “generación de Internet” (net generation). Los estudiantes están acostumbrados a vivir con las TIC en su vida diaria, pero las escuelas no siempre les proporcionan el soporte tecnológico apropiado en sus actividades de aprendizaje. Además, muchos de los estudiantes actuales son consumidores de videojuegos. El número de jugadores se ha incrementado en los últimos años y se ha elevado el promedio de jugadores. Los estudios recientes muestran que el promedio de los jugadores de hoy es de 30 años, con el 68% de los jugadores mayores de 18 años. La popularidad de los juegos digitales ha generado un rápido desarrollo de la industria del videojuego en la pasada década, con considerables avances que han ampliado la definición de los juegos y cómo jugar a ellos. Los juegos se han venido utilizando en escenarios educativos y de formación desde hace tiempo, pero la elaboración de juegos con fines de aprendizaje tiene altos costes de desarrollo.

Los nativos digitales también son jugadores, es decir, la mayoría de ellos tienen experiencias relacionadas con el uso de los juegos digitales como jugadores ocasionales o como jugadores expertos. Juegan solos o interactuando con otros jugadores a través de las redes. Los nativos digitales están, por tanto, familiarizados con la estética de los juegos. Estos nativos digitales necesitan nuevas formas de aprendizaje, más interactivas, participativas e individualizadas, que puedan ayudarles en la creación, la colaboración y el intercambio de conocimientos con sus compañeros, maestros, padres y comunidades educativas. Las escuelas de hoy, aunque tratan de mantener el ritmo con las tecnologías digitales, todavía tienen que lidiar con los estudiantes no comprometidos. Todos estos
aspectos relacionados con el uso de las TIC en la educación pueden resumirse en los siguientes puntos:

- Existencia de una generación de individuos comúnmente conocidos como nativos digitales que siempre ha vivido con las TIC y que además, son jugadores;
- Los nativos digitales también están familiarizados con el uso de aplicaciones en redes sociales;
- Se considera que los nativos digitales padecen una falta de motivación y de compromiso en lo que a las actividades escolares tradicionales se refiere;
- Aunque los profesores ya están utilizando las TIC, todavía están buscando los medios adecuados para utilizar estas tecnologías, y para adaptarse a las nuevas realidades tecnológicas y sociales;
- Los videojuegos tienen un papel cada vez más importante en el entretenimiento, pero su influencia ha llegado a muchas áreas diferentes, principalmente a la educación;
- Los juegos y los videojuegos se han utilizado en educación desde hace tiempo, pero recientemente el enfoque de aprendizaje que se ha basado en juegos digitales (Digital Game-based Learning) ha ganado notoriedad;
- La tendencia reciente conocida como gamificación parece ser valiosa mediante la mejora de la motivación, el compromiso y la inducción a un cambio de comportamiento.

Las Tecnologías de la Información y Comunicación en Educación

El fuerte desarrollo de las TIC permitió el desarrollo de estrategias de enseñanza apoyadas por estas tecnologías que dieron lugar al concepto de e-learning, el cual, en esencia, designa los sistemas de aprendizaje que utilizan medios electrónicos sin contacto y proximidad física entre profesores y estudiantes. El concepto ha evolucionado, alejándose de la simple connotación con la educación a distancia para designar el uso de diversas herramientas tecnológicas, en particular las relacionados con las TIC. Ya sea como una ayuda para la enseñanza en un aula tradicional, en los sistemas de educación a distancia o en escenarios mixtos, el e-learning está ahora totalmente vinculado a la educación. Las limitaciones del e-learning desde un punto de vista pedagógico se centran en las dificultades para transmitir emoción o involucrar al estudiante de la misma forma que un profesor podría hacerlo. Por esta falta de sensibilidad o de interacción emocional,
el sistema de e-learning debe compensar y tratar de estimular a los alumnos por otros medios.

Además, en la educación, la Web 2.0 trajo nuevos conceptos como los Entornos Personales de Aprendizaje (PLE, Personal Learning Environments) y los Entornos Sociales de Aprendizaje (SLE, Social Learning Environments), en los que el estudiante está en el centro del proceso, redefiniendo las estrategias y las metodologías de la aprendizaje. Un PLE es un entorno de aprendizaje integrado y centrado en el usuario no sólo para apoyar el auto-aprendizaje, sino también para apoyar el aprendizaje en grupo. Por lo tanto, queda claro que un PLE no es una tecnología, sino un enfoque que implica un alto nivel de autonomía, necesario para gestionar todas las herramientas disponibles. Un SLE, por otra parte, es una manera particular de ver el concepto de PLE, trabajando sobre una plataforma tecnológica que incluya o permita el acceso a diferentes herramientas y aplicaciones, principalmente las aplicaciones de la Web 2.0. Estas herramientas ayudan a los estudiantes a aprender y a socializar. Pero, al igual que en otras plataformas digitales enfocadas al aprendizaje, el SLE necesita usuarios motivados y comprometidos para ser eficaz.

**Juegos y Aprendizaje**

No es sencillo definir un juego, pero sí es sencillo asumir que la motivación está directamente vinculada a éste. De hecho, los jugadores suelen tener altos niveles de compromiso con el juego, resultando en algunos casos, casi un entretenimiento aditivo. Los videojuegos, por otra parte, no son más que una evolución de los juegos tradicionales que aparecieron en la segunda mitad del siglo XX junto con los primeros ordenadores digitales.

Hoy en día, los videojuegos ya no son una sola aplicación de software que se ejecuta en un ordenador personal o en una consola de juegos. Las redes de ordenadores hacen de los videojuegos un espacio virtual donde los jugadores desde cualquier lugar del mundo pueden reunirse para jugar entre sí o contra otros. La evolución en las capacidades gráficas de hardware ha contribuido decisivamente al desarrollo de la industria de los videojuegos. Además, la Web 2.0 trajo un componente social provocando un notorio aumento en el número de jugadores. Finalmente, las tecnologías móviles permiten disfrutar de los juegos desde cualquier parte.

Los juegos sociales son un tipo de videojuegos que se hacen populares entre los usuarios de las redes sociales. El número de jugadores sociales ha crecido significativamente en los últimos años, y la mayoría de ellos utilizan dispositivos móviles para jugar. Los juegos sociales se utilizan como una forma de interactuar con los amigos y no sólo son parte de la cultura de los nativos digitales, sino que también llegan a un público más amplio. En
Resumen

los juegos sociales, los jugadores tienen que realizar tareas con objetivos claros, y pueden recibir insignias u otros trofeos cada vez que tienen éxito. Estos logros se pueden utilizar para obtener acceso a nuevos retos más exigentes. Los trofeos ganados por un jugador pueden ser compartidos en las redes sociales de los jugadores, actuando así tanto como un reconocimiento social como de estímulo para otros usuarios. Es habitual, también, que los jugadores de juegos sociales puedan unirse en grupos y formar comunidades para poder superar juntos los retos que son demasiado difíciles para un único jugador.

Aunque los videojuegos se utilizan en la educación casi desde que los ordenadores entraron en las clases, la Web 2.0 y los juegos sociales trajeron nuevas posibilidades en los entornos de aprendizaje. De hecho, el aprendizaje basado en juegos digitales ya es una realidad, aunque existen todavía muchas dificultades y barreras en su uso, tanto por parte de los profesores como de los estudiantes. Hasta el momento, el aprendizaje basado en los juegos digitales ha sido aplicado por los educadores bajo tres enfoques principales:

- El uso de videojuegos comerciales genéricos, cuando estos tienen contenidos que pueden ser utilizados con fines educativos;
- El uso de Juegos Serios (del inglés “Serious Games”), un tipo de videojuegos en los que el aprendizaje es el objetivo principal;
- Los estudiantes que construyen sus propios juegos, lo que permite el desarrollo de habilidades útiles para la resolución de problemas, destrezas de programación y de diseño de juegos.

Estos tres enfoques tienen algunos inconvenientes y plantean desafíos complejos. Los videojuegos comerciales tienen varias limitaciones ya que los contenidos son limitados y pueden no ser completos o precisos. El aprendizaje se produce sólo como un efecto secundario. No todos los videojuegos comerciales tienen el mismo potencial y muchos de ellos tienen un valor educativo dudoso. La producción de los Juegos Serios, con la calidad de los videojuegos comerciales requiere grandes presupuestos. Éste es un gran inconveniente porque la escasez de juegos educativos de calidad es una fuerte barrera ante una adopción más amplia en las escuelas. Cuando los estudiantes construyen sus propios juegos, los profesores también necesitan tener experiencia en el diseño y el desarrollo de juegos, lo que es difícil para la mayoría de las asignaturas.

Gamificación: Una Nueva Tendencia

La creciente popularidad de los videojuegos y la generalización de las tecnologías digitales dieron lugar a una nueva tendencia basada en aplicar las características de los
videojuegos en las actividades y contextos no relacionados con los videojuegos, e incluso no relacionadas con la tecnología. Esta tendencia ha sido popularizada bajo el nombre de gamificación. En los medios digitales, el término original (gamification), fue mencionado por primera vez en 2008, pero no fue hasta 2010 cuando el término fue ampliamente adoptado. De hecho, el término solamente comenzó a ser buscado en Google en agosto de 2010.

El principal objetivo es que, moviendo los componentes del juego a otros contextos, es posible inducir, en las personas que actúan en esos contextos, el mismo compromiso que los jugadores sienten cuando juegan a un juego. Si las personas están profundamente motivadas y comprometidas con la tarea que están realizando, será más probable que exhiban los comportamientos adecuados en relación con la finalización de esa tarea. Por lo tanto, se supone que la gamificación motiva a los usuarios y, bajo esta premisa, ha sido implementada en una amplia gama de áreas: programas de fidelización, campañas de marketing, aprendizaje de idiomas, redes sociales, intranets corporativas, cuidado de la salud o la educación.

Sin embargo, la gamificación no es un juego ni un intento para hacer simplemente una aplicación como un juego, tampoco es la construcción de juegos en toda regla, como ocurre en los denominados Juegos Serios. Del mismo modo, la gamificación de la educación no es lo mismo que el aprendizaje basado en juegos digitales. Por lo tanto, la gamificación no debe confundirse con un proceso de transformación de una actividad no lúdica en un juego. En cuanto a la educación, su aplicación no significa que todos los contenidos de las distintas asignaturas se impartan en forma de un juego. En definitiva, la gamificación es “el uso de elementos de diseño de juegos en contextos no lúdicos”.

La gamificación en la educación y en la formación es otra manera de utilizar el poder de los juegos para promover el compromiso, aumentar la motivación y hacer que el aprendizaje sea divertido. La gamificación tiene un gran potencial para motivar a los estudiantes y hacer que la escuela sea más atractiva. Tiene la ventaja de introducir lo que realmente importa en el mundo de los videojuegos - aumentar el nivel de compromiso y el fomento de la motivación - sin utilizar ningún juego en concreto. Suponiendo que a los niños y a los adolescentes les gusta jugar a los videojuegos, pero no están suficientemente involucrados en las actividades escolares - lo que lleva a la desmotivación - la gamificación de la educación es un proceso para inducir la motivación en esas actividades y para que los estudiantes se dediquen a ellas mediante el cambio de sus comportamientos.

La gamificación se expandió a muchas áreas diferentes y, en la actualidad, existen diversas plataformas y herramientas de gamificación que están actualmente disponibles, algunas de ellas en el ámbito educativo. Además, y dado que el término gamificación
llamó la atención de la academia y la industria, se propusieron varios intentos para sistematizar su aplicación en diferentes dominios. Algunos de estos intentos se analizan en esta tesis.

**Gamificación y Psicología**

Para justificar y ayudar a entender los beneficios de la utilización de componentes de juegos en contextos no lúdicos, se han utilizado varias teorías e investigaciones en el campo de la psicología. La comprensión de las teorías de psicología es vital para el diseño de sistemas gamificados. Esta tesis analiza cómo se relacionan estas teorías y enfoques y cómo pueden contribuir a un framework de gamificación que soporte el diseño de aplicaciones gamificadas.

Estar motivado significa tener interés en hacer algo y es éste un tema tan controvertido que diferentes teorías psicológicas se centran en intentar explicar cómo conseguir que la gente haga cosas: como la Teoría de la Autodeterminación, relativa a la motivación intrínseca y la motivación extrínseca, o el Modelo de Comportamiento de Fogg, un modelo para comprender lo que impulsa comportamiento humano. Todos estos planteamientos tratan de comprender lo que motiva a las personas a actuar, cómo se pueden modificar sus comportamientos, por qué a la gente le gusta hacer algunas cosas y no le gusta hacer otras, y cuáles son los incentivos adecuados para mantener las personas motivadas y comprometidas con una actividad.

De todas las teorías estudiadas, la Teoría del Flujo jugó un papel central en la investigación de esta de tesis. Es una de las teorías más citadas en la literatura sobre gamificación. Al flujo también se le llama la experiencia óptima. En un estado de flujo, una persona realiza una actividad por sí misma y no por sus consecuencias o recompensas. Para alcanzar el estado de flujo, la persona debe estar intrínsecamente motivada para desarrollar la actividad. Por lo tanto, una persona puede mantenerse en el estado de flujo si hay un equilibrio entre sus habilidades y el reto que la persona tiene que hacer frente. Si las habilidades de una persona son bajas en relación con el desafío, surgirá un sentimiento de preocupación o ansiedad. Si las habilidades son altas, entonces se experimentará una sensación de aburrimiento o de relajación. Para una persona que se mantiene en un estado de flujo, la dificultad del reto debe aumentar junto con el aumento en las habilidades de la persona. La ausencia de un desafío significativo y habilidades bajas llevan a la persona a un estado de apatía. En la perspectiva de esta tesis, el flujo es considerado lo mismo que el compromiso con un sentido de control o autonomía.

**Investigación en Gamificación**

La revisión de la literatura presentada en esta tesis reveló que, a pesar de que varios artículos académicos se han publicado desde 2010, todavía falta investigación empírica
sobre el uso y los beneficios de la gamificación en sus diversos campos de aplicación. Tampoco se han encontrado suficientes evidencias empíricas sobre los beneficios del uso de la gamificación en la escuela y en la formación corporativa. En particular, con respecto a la gamificación para la educación primaria, la investigación es escasa. Sin embargo, la educación es el contexto más común encontrado en la investigación sobre este tema. Una otra conclusión importante de la revisión de la literatura es que la gamificación, en general, produce efectos y beneficios positivos y la gamificación de la educación tiene un impacto potencial positivo en el aprendizaje.

Cuestiones de Investigación y Objetivo de la Tesis

El principal objetivo de la tesis surge de las siguientes cuestiones: ¿cuál es la manera más eficaz de utilizar la gamificación social para mejorar la participación de los estudiantes en un Entorno Social de Aprendizaje (SLE)? y ¿un Entorno Social de Aprendizaje gamificado lleva a mayor disposición de los estudiantes para experimentar el flujo?

Después de definir las cuestiones de investigación, se estableció el objetivo que se propone en esta tesis: el uso de un enfoque social de la gamificación en un Entorno Social de Aprendizaje, aplicando los buenos principios del aprendizaje que se encuentran en los juegos y con el apoyo de un framework adecuado, puede fomentar la motivación y el compromiso de los estudiantes mediante el aumento de su tendencia a experimentar flujo.

Contribución Principal

La principal aportación de esta tesis es un framework de gamificación social, que incluye una arquitectura de referencia para ayudar al diseño e implementación de sistemas de software gamificados, así como una guía para su aplicación en un contexto no lúdico.

El framework propuesto, llamado GET7 (7 Game Elements and 7 Game Techniques), tiene por objeto ayudar a los diseñadores y desarrolladores de aplicaciones gamificadas a comprender qué componentes incluir, cómo se relacionan y cómo utilizarlos con eficacia. GET7 se basa en la teoría de flujo junto con otras teorías de psicología. Para hacer frente a los objetivos de esta tesis, GET7 debe ser capaz de apoyar el desarrollo de sistemas gamificados que aumenten la tendencia de los usuarios a experimentar el flujo, lo que hace que los jugadores se mantengan en un canal de flujo evitando el aburrimiento y la ansiedad.

GET7 evoluciona desde un conjunto de conceptos fundamentales:

- Equilibrio habilidad/desafío;
- Autonomía y control;
Resumen

- Retroalimentación y recompensas;
- “Amigos” (Friends);
- Flujo y Diversión.

A partir de estos conceptos básicos emergen los componentes de GET7: un conjunto de 7 elementos de juego y 7 técnicas de juego:

- Elementos: Sistemas de puntos; Insignias (badges); Tablas de clasificación (leaderboards); Niveles; Barras de progreso; Gráficos sociales; Monedas virtuales.
- Técnicas: Objetivos claros e objetivos intermedios; Desbloqueo de contenido (o revelación progresiva); La presión del tiempo; Libertad para fallar; Libertad de elección; Interacciones sociales (o compromiso social); Economía virtual.


Finalmente, GET7 se completa con un guía para ayudar a los diseñadores en el desarrollo de sistemas gamificados basados en la arquitectura propuesta. La guía tiene la intención de ayudar a los diseñadores en la elección de las técnicas y de los elementos de juego adecuados para un entorno no lúdico en particular. La guía, con siete pasos, ofrece instrucciones tanto para el diseñador como para los usuarios.

Otras Contribuciones

Además de la principal aportación de esta tesis, presentada anteriormente, a lo largo del trabajo de investigación, surgieron otras contribuciones. Estas otras contribuciones pueden resumirse en los siguientes puntos:

- Una definición de lo que son las mecánicas o las reglas de juego, las dinámicas de juego, los elementos de juego y las técnicas de juego;
• Una identificación de los elementos y de las técnicas de juego más utilizadas en entornos de aprendizaje;

• Una propuesta de una definición para la gamificación en general, para la gamificación de la educación y para la gamificación social;

• Una contribución a la investigación empírica sobre el uso de gamificación en plataformas tecnológicas.

La primera de las contribuciones anteriores se debió a la necesidad de un discurso más uniforme sobre la gamificación. En la revisión de la literatura para esta tesis, se encontró una distinción poco clara entre varios conceptos. Por lo tanto, se propusieron los siguientes términos, con el significado correspondiente:

• Elementos de juego: los elementos de diseño de juegos o simplemente elementos de juego son el conjunto de componentes de juego que se encuentran en diferentes tipos de juegos y son comunes a la mayoría de ellos. Estos elementos son normalmente componentes visuales de los que los jugadores son conscientes cuando juegan. Los ejemplos de elementos de juego son sistemas de puntos, insignias, niveles o tablas de clasificación.

• Reglas: Las reglas hacen referencia a cómo se utilizan los elementos de juego. Aunque mecánicas de juego sería probablemente un término más adecuado, se adopta el término “reglas” para evitar cualquier posible malentendido con elementos de juego, ya que en la mayor parte de la literatura de gamificación, los términos “elementos” y “mecánicas” se utilizan indistintamente. Las reglas rigen el funcionamiento de los elementos de juego: cómo interactúan y cómo aplican las técnicas de juego.

• Dinámicas de juego: las dinámicas son las emociones provocadas en los jugadores por el ambiente gamificado. Las dinámicas determinan las reacciones del individuo como respuesta a la utilización de las reglas y técnicas aplicadas a los elementos de juego. El estatuto social, la autoexpresión, la competición y el altruismo son ejemplos de dinámicas de juego. Las dinámicas de juego son los resultados del juego en relación con las emociones sentidas por los jugadores.

• Técnicas de juego: las técnicas de juego se deben entender como las estrategias y los heurísticos utilizados por los diseñadores de juegos para mantener a los jugadores involucrados, aumentando su motivación para seguir jugando.

Los elementos de juego son las herramientas para poner en práctica las técnicas de juego. Las reglas indican cómo funcionan los elementos de juego, como consecuencia de
las acciones de los jugadores. Las dinámicas de juego son los resultados de un sistema gamificado, las emociones y las reacciones de los jugadores a las técnicas aplicadas. El flujo, la experiencia óptima, puede ser alcanzado por una correcta aplicación de las técnicas de juego.

En cuanto a la segunda de las contribuciones anteriores, los elementos y las técnicas de juego más utilizadas fueron encontradas en la revisión de la literatura y también en las aplicaciones gamificadas que se analizaron en el trabajo de investigación. Desafíos, la revelación progresiva, la libertad de fracasar, la libertad de elección, y el compromiso social son algunas de las técnicas más utilizadas.

En esta tesis, se adoptó una definición más completa para gamificación: el uso de los elementos y técnicas de juego en contextos no lúdicos, para impulsar el compromiso así como para promover comportamientos objetivos deseados. La definición de la tesis subraya el propósito de utilizar elementos de juego fuera de entornos lúdicos (es decir, proporcionar un compromiso en entornos no lúdicos idéntico al compromiso que se encuentra en los juegos) y el objetivo final de todo el proceso (es decir, promover algunos comportamientos objetivo en los participantes).

La noción más especializada de la gamificación social también fue utilizada en esta tesis y se adoptó la siguiente definición: el uso de elementos de diseño de los juegos sociales en contextos no lúdicos, para llegar al compromiso y a las interacciones sociales, con el fin de promover comportamientos deseados. Para la gamificación social, se adoptó la siguiente definición: la utilización de elementos de juego y técnicas de juego en entornos tecnológicos de aprendizaje con el fin de mejorar la motivación y el compromiso de los estudiantes.

La última contribución de esta tesis es el estudio empírico detallado en el apartado siguiente.

**Validación de la Tesis**

La validación de la tesis se basa en los resultados de dos evaluaciones diferentes: una encuesta sobre el uso de la guía de GET7 y un experimento controlado para evaluar el framework.

La encuesta fue dirigida a un conjunto de sujetos que actuaban como diseñadores de sistemas gamificados mediante la utilización de la guía de GET7. Para evaluar la guía, los participantes respondieron a un cuestionario en línea. La encuesta reveló que los participantes consideraron la guía útil y bien estructurada. A partir de los resultados de la encuesta, se hicieron algunos cambios menores en la definición inicial de la guía y se utilizó una versión final en el estudio empírico.
Con el fin de evaluar la eficacia del framework propuesto y para responder a la segunda cuestión de investigación de la tesis (¿un Entorno Social de Aprendizaje gamificado lleva a mayor disposición de los estudiantes para experimentar el flujo?), se realizó un experimento para medir el efecto de un SLE gamificado en la participación de sus usuarios (los jugadores). El flujo se utilizó como una medida del compromiso de los estudiantes. Una escala de flujo, un cuestionario basado en la versión portuguesa de la “Disposition Flow Scale-2” (DFS-2), se aplicó en el experimento, para evaluar la tendencia de los sujetos para experimentar el estado de flujo. El propósito general del experimento fue probar la hipótesis de que una versión gamificada de un SLE provoca en sus usuarios un aumento de su disposición para experimentar el flujo que la versión no lúdica, siguiendo la cuestión de investigación anterior. Schoooools fue el SLE utilizado en el experimento. Los sujetos del experimento fueron 26 alumnos de una clase de tercer año (año académico de 2014/2015) de una escuela primaria portuguesa.

El experimento consultó a los sujetos antes (pre-test) y después (post-test) del tratamiento (el uso de la versión gamificada de Schoooools). El efecto se tomó como la diferencia entre los resultados del post-test y los resultados del pre-test. El experimento tuvo algunas limitaciones a la generalización, pero fue posible concluir que la clase tuvo un aumento estadísticamente significativo en la tendencia de los estudiantes a experimentar el flujo durante el uso de la versión gamificada de Schoooools. Estos resultados permiten aceptar la hipótesis de la investigación: una versión gamificada de un SLE causó en sus usuarios un aumento de su disposición a experimentar el flujo frente a la versión no lúdica.

Conclusiones

Esta tesis ha investigado el problema de cómo una nueva tendencia, conocida como gamificación, podría utilizarse para mejorar la motivación y el compromiso de los estudiantes dentro de un Entorno Social de Aprendizaje. El problema se abordó mediante la propuesta de un framework para una aplicación efectiva y sistemática de la gamificación. Esta framework, GET7, incluye un conjunto de elementos y técnicas de juego basados en algunos conceptos básicos. Se pretende que los conceptos básicos sean los fundamentos teóricos de la estructura, aplicando los conceptos más importantes de las principales teorías psicológicas que han estado apoyando los estudios sobre gamificación.

Este trabajo de investigación buscó varias aplicaciones gamificadas, en contextos educativos, para encontrar qué elementos de juego se utilizan más y cómo. Este trabajo preliminar mostró que, aunque se conocen algunas propuestas de frameworks y metodologías de gamificación, no existe ninguna comúnmente aceptada. Aunque se conocen estas propuestas, no es conocida ninguna arquitectura formal que incluye los los componentes y bloques de construcción de aplicaciones gamificadas. En su mayoría, estas propuestas
son guías paso a paso, basadas en observaciones simples de las aplicaciones existentes, sin consideraciones sobre las respectivas arquitecturas. Algunas de ellas son específicas para un cierto tipo de aplicaciones o para un contexto particular no lúdico. No se conoce también ninguna validación científica de la mayor parte de estos frameworks y metodologías. Gran parte del trabajo conocido sobre los frameworks de gamificación se ha centrado más en los medios y directrices para aplicar la gamificación y para ayudar a los diseñadores a aprender rápidamente cómo implementar una aplicación, y menos en la definición de una arquitectura de referencia para sistemas gamificados.

Por lo tanto, GET7 incluye una arquitectura de referencia con los principales bloques de construcción que se deben considerar en el desarrollo de un sistema gamificado. La arquitectura de referencia para el framework propuesto es independiente de la plataforma y no se ocupa de los detalles de implementación. Por último, al igual que algunas de las propuestas de frameworks de gamificación conocidas, GET7 también incluye una guía sobre cómo implementar actividades gamificadas utilizando una plataforma inspirada en la arquitectura propuesta.

El experimento realizado permitió validar la hipótesis de la tesis. Aunque pequeño, se observó un incremento en la tendencia de los estudiantes a experimentar el flujo, particularmente en las dimensiones de flujo relacionadas con los resultados del mismo. Sin embargo, se debe considerar con precaución la generalización de estos resultados.

Los objetivos de la investigación fueron alcanzados y se dio respuesta a las cuestiones de investigación. Para la primera cuestión - ¿cuál es la manera más eficaz de utilizar la gamificación social para mejorar la participación de los estudiantes en un Entorno Social de Aprendizaje (SLE)? - se encontró que el enfoque social de la gamificación, donde los elementos de juego no sólo son vistos como recompensas sino como medios para mejorar la motivación intrínseca de los usuarios y para aumentar su tendencia a experimentar el flujo, se podrían aplicar eficazmente mediante el establecimiento de un framework adecuado. Para la segunda cuestión - ¿un Entorno Social de Aprendizaje gamificado lleva a mayor disposición de los estudiantes para experimentar el flujo? - el experimento realizado halló que las actividades gamificadas en un SLE inspirado en el framework propuesto, los usuarios tienden a experimentar flujo.

A partir de los resultados presentados en esta tesis, se puede concluir que la gamificación aplicada a un ambiente de aprendizaje tecnológico apoyado por el framework propuesto, puede contribuir al compromiso y a la motivación de los estudiantes.
Bibliography


Raczkowski, F. (2013). It’s all fun and games... a history of ideas concerning gamification. In *Proceedings of DiGRA 2013: DeFragging Game Studies*.


