Chapter 12
A Software Testing Process Based in Gamification for Children With Down Syndrome

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ABSTRACT
Evaluating software implies challenging users’ abilities during a period, applying several assessments, and analyzing their evolution. This process might turn unpleasant and stressful, especially to those susceptible to anxiety and stress, such as Down syndrome users. The poor performance of unpleasant users generates unreal results. A gamified approach for software testing is proposed that maintains user motivation and engagement and reduces anxiety and stress. Common behaviors expected are anxiety, stress, unwilling to work, and in general, lack of motivation. Using gamification, makes it possible to succeed in controlling these common negative behaviors and stimulating the positive ones including the MDA framework into a generic learnability evaluation process, linking these two elements with the psychological approach of gestalt therapy. Gamifying the testing experience increased the quality of communication between users and applicators; provided a friendly, motivational, and engaging environment; and increased the rate of testing success and the range of potential participants.

INTRODUCTION
When users of a software product start to interact with it, they begin a process that can be either the most pleasant experience or the worst. Usable software products are commonly perceived as the most useful, efficient, and lofty. To assure software usability, developers and designers must know how their products cover all learning needs of goal-users. User evaluation of software products has shown to enhance user-needs fitting in usability, accessibility, ergonomics and learning. Software evaluation involving
users means analysing the way users interact with it, and it is one of the most important aspects of User Centered Design (Barendregt, Bekker, Bouwhuis, & Baauw, 2007).

Testing in the software development process is mandatory; nevertheless, for some users the experience of being tested may turn unpleasant; in fact, all software testing involving users generate certain levels of anxiety and stress. Klemer explain that users might feel uncomfortable during evaluation due to (Klemer, 2016):

- Compromising to make things well
- Feeling of being observed
- Challenging of capabilities
- Error making afraid
- Changing of the ordinary working space

Users’ discomfort may affect their performance in evaluation and reliability of resulting data. This is the reason of why is important to provide a friendly evaluation environment to users. Enhancing testing experiences, allow a deeper understanding of learning strategies and preferences of users (Kirijian, Myers, & Charland, 2007), and enhance reliability of the study results. This research presents a software testing process based on gamification -bringing the game experience to software evaluation. It allows maintaining the user’s motivation and engagement, reducing anxiety and stress, during the whole testing process, and takes especially care of the Down syndrome users’ characteristics in communication, socialization, and behaviour.

BACKGROUND

Testing With Users

User testing, can provide both quantitative and qualitative information about software’s learnability. It depends of the technique(s) followed by applicators, the most common are:

**Quantitative Information:** In (Butler, 1985), authors presented a case of study where they test a financial system by analysing the users’ performance (time to mastery and error avoidance/recovery) in a set of tasks with a predefined level of expected success. In (Baxter & Oatley, 1991) authors tested two spreadsheet software measuring the performance of 16 navy users and 16 experts in 14 tasks. They found that previous experience has a large effect on tasks scores not the brand of the software previously learned. Many other authors have used the method of task performance to assess learnability (Chapanis, 1991), (Davis & Wiedenbeck, 1998) (Raisamo & Räihä, 2000), (Elliott, 2002), (Ziefle M. .., 2002), (Rafique, Jingnong, Wang, Abbasi, & Lew, 2012), (Zbick, Nake, Milrad, & Jansen, 2015).

**Qualitative Information:** Authors complemented the qualitative data from the testing with a questionnaire about the quality of certain features of the system. Results of the performance testing let the authors know that the current version of the system surpassed the expectations in learnability. The questionnaire results let them to identify features of the system where improvement was needed. The think-aloud protocol consists basically in encourage users to verbalize the learnability experi-