DYNAMIC SCAFFOLDING, ASSESSMENT, AND GAMIFICATION USING UNICORDERNOTEBOOK™

T. Iliev

IPT – Intellectual Products & Technologies Ltd. (BULGARIA)

Abstract

Recently Jupyter, nTeract, and Observable notebooks gained popularity as tools for active learning and experimentation. Notebooks combine ability for interactive coding with immediate presentation of the results and rich data visualization. They can be exported, imported, shared, parameterized and can even combine scripts written in different programming languages. In order to provide enough structure (scaffolding), scripts can be mixed with description markup written in HTML, SVG, Markdown, LaTeX, etc. This makes notebooks self-explaining and allows to “tell” the learning material as an intriguing story in which the learning experience “develops” during a number of interactive experimentation steps.

Dynamic assessment is an interactive approach to psychological or psychoeducational assessment where intervention is embedded within the assessment procedure.

The paper proposes a novel interactive notebook and gamification framework called UnicorderNotebook™ combined with a method for dynamic, instructor-supervised, real-time assessment and adaptation of learning activities - Unicoder™ Integral Game-Based Learning (Unicoder IGBL) method. IPT UnicorderNotebook™ builds upon existing Challenge Unicorder™ system (described in previous author's publications) allowing students to continuously log their progress along the learning path of challenges, missions, and actions. This logging is done in multimodal (picture, text, audio, video), low effort graphical user interface. The collected data is used to gamify the learning process, to allow immediate feedback and achievement recognition, as well as to present multimedia “stories” about the achievements. It uses continuous real-time assessment of learners’ performance for dynamic sequential and structural adaptation of the presented challenge actions.

This publication focuses on dynamic scaffolding and gamification of the learning process by providing enough context and structure in form of linear or non-linear sequence of interactive cells (actions in chosen gamification terminology). The sequence of these actions can be adapted according to real-time assessment of the learner's performance. Some of the actions (notebook cells) are optional – they are called “Easter Eggs” and are presented only if the estimated performance is sufficiently high. This allows to adapt the difficulty of missions and challenges according to learner's abilities, and to fit the mission (notebook) duration in constant time.

Unicoder IGBL method guides the design of gamified notebooks in accordance with Vygotsky's Zone of Proximal Development (ZPD) principle. The game design follows well-known MDA (Mechanics, Dynamics, Aesthetics) framework. The gamification terminology is translated to the learning domain - challenges are mapped to learning goals, missions follow an engaging storyline (learning path), points and feedback are given in real time (positive reinforcement), dashboard provides immediate feedback (learning analytics), badges and tokens improve motivation. Both forces of competition and collaboration are employed to design engaging and productive learning experience (LX). Aesthetics is divided in eight categories: Sensation, Fantasy, Narrative, Challenge, Fellowship, Discovery, Expression, and Submission. Examples are given how to support them using UnicorderNotebook™.

The evaluation of the proposed framework is work in progress. Some preliminary results are discussed.

Keywords: Notebook, dynamic assessment, logging, adaptive learning, learning analytics, game-based learning, gamification, active learning, pedagogical method.