

Motivating Learners by Dynamic Score and Personalized Activity Stream

Richard Filipčík and Mária Bieliková

Slovak University of Technology in Bratislava

maria.bielikova@stuba.sk



PeWe@FIIT
personalized web group

Motivation for this work is

motivation in learning process



We use game elements and mechanics in learning context

gamification

- Badges, pointing systems, leaderboards, ...

338

RETWEETS

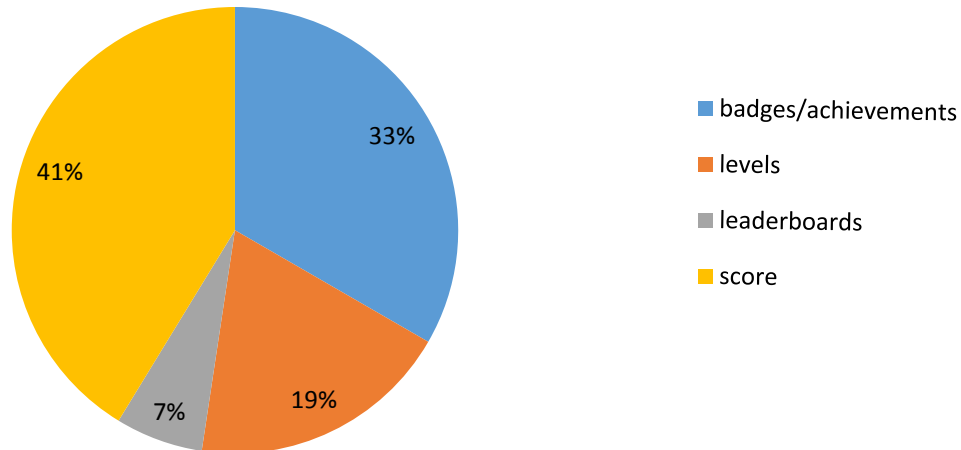
236

FAVORITES



Students like score and badges

What gamification element you consider to be most attractive in ALEF?



Score computation that
can limit unnecessary
and pointless activity of
students.

Can we assign “right score” to each activity?

We proposed a **method of a dynamic score computation**, which works as an extension to the basic (static) score computation.

Dynamic score is proposed for web-based educational system

The screenshot displays the AleF web-based educational system interface. The top navigation bar includes a home icon, the AleF logo, and menu items for Administration, SI, Lisp, and C. The user is identified as Marian Simko (administrator) with a Log out link.

The main content area is titled "Function CONS" and includes a filter bar with icons for search, list, and other functions. The text explains that CONS creates a non-empty list and provides a scheme for its arguments. A code editor shows the example: `(CONS new-first-element list)`.

The right sidebar contains several widgets: "Your score" (52.3), "Reported errors" (none), "Tags" (CONS function), and "External sources" (Functional programming - Wikipedia, the free e...).

Annotations are present throughout the interface:

- 1: A yellow circle highlights the "Recommended" sidebar menu.
- 2: A yellow circle highlights the "Exercises" tab in the left sidebar.
- 3: A yellow circle highlights the code editor input field.
- 4: A yellow circle highlights the "Your score" widget.
- 5: A yellow circle highlights the "Reported errors" widget.
- 6: A yellow circle highlights the "Tags" widget.
- 7: A yellow circle highlights the "External sources" widget.

Score computation is based on students' activities in ALEF

- doing exercises,
- asking and answering questions,
- reading texts,
- highlighting text
- tagging
- ...

I as a teacher often prefer some of the activities



But what is typical
students' behavior?

Balancing factor

Score computation is incremental

$$score(s, t) = score(s, t - 1) + \sum_i partial_score(C_i, s, t)$$

- summing up *previous score value* and *sum of all partial scores* earned in current time period

Partial score computation is based on three factors

- Activity weight (static)
- Activity preference (set by the teacher)
- Students' actions in the educational system (dynamic)

$$\begin{aligned} \text{partial_score}(c, s, t) \\ = \text{weight}(c) * \text{pref}(c, t) * \text{bal}(c, t) * \text{add}(c, s, t) \end{aligned}$$

c is particular activity, s is student, t is time interval of computation,
 $\text{weight}(c)$ returns activity weight,
 $\text{pref}(c, t)$ returns activity preference,
 $\text{bal}(c, t)$ returns activity balance factor
 $\text{add}(c, s, t)$ returns amount of points for performing activity.



Balancing factor reflects students' activity

- Students affect *balancing factor* by their actions represented by a ratio of
 - **expected ratio** of score received to all score received (based on activity weight)
 - **current ratio** of score received to all score received
- Example
 - Expected 2/5 of all points to be earned by adding comments
 - 3/5 of all points earned by adding comments so far
 - Balancing factor for adding comments set to 0.667

$$\frac{\frac{2}{5}}{\frac{3}{5}} = \frac{0.4}{0.6} = 0.\bar{6}$$



Having the right information at the right time by activity stream

Hello, Richard

Below you can see some stats for your courses.

Lisp

You have earned **23.6** points in the Lisp course so far, where

- most of them you have earned for **reading explanations** and
- least of them you have earned for **posting comments**.

Your badges



Recent activity

New badge unlocked



2.5.2014, 17:42

Martin Labaj has unlocked new badge - Score (level 2).

Bonus points change in the Lisp course



2.5.2014, 17:42

Amount of bonus points has changed in this course. You can gain most points for:

- ▲ *highlighting* (high)
- ▼ *working with question validator* (high)
- ▲ *answering questions* (high)

You will earn least points for following activities:

- ▲ *rating summaries* (low)
- ▲ *doing exercises* (low)
- ▼ *reading explanations* (lower)

Experiment

The logo for the experiment, featuring the word "AleF" in a white, handwritten-style font on a solid orange rectangular background.

- 2 weeks - uncontrolled form
- based on activity of 223 students of Principles of Software Engineering course

Tested impact of dynamic score and activity stream on students' decisions of what activity to perform next



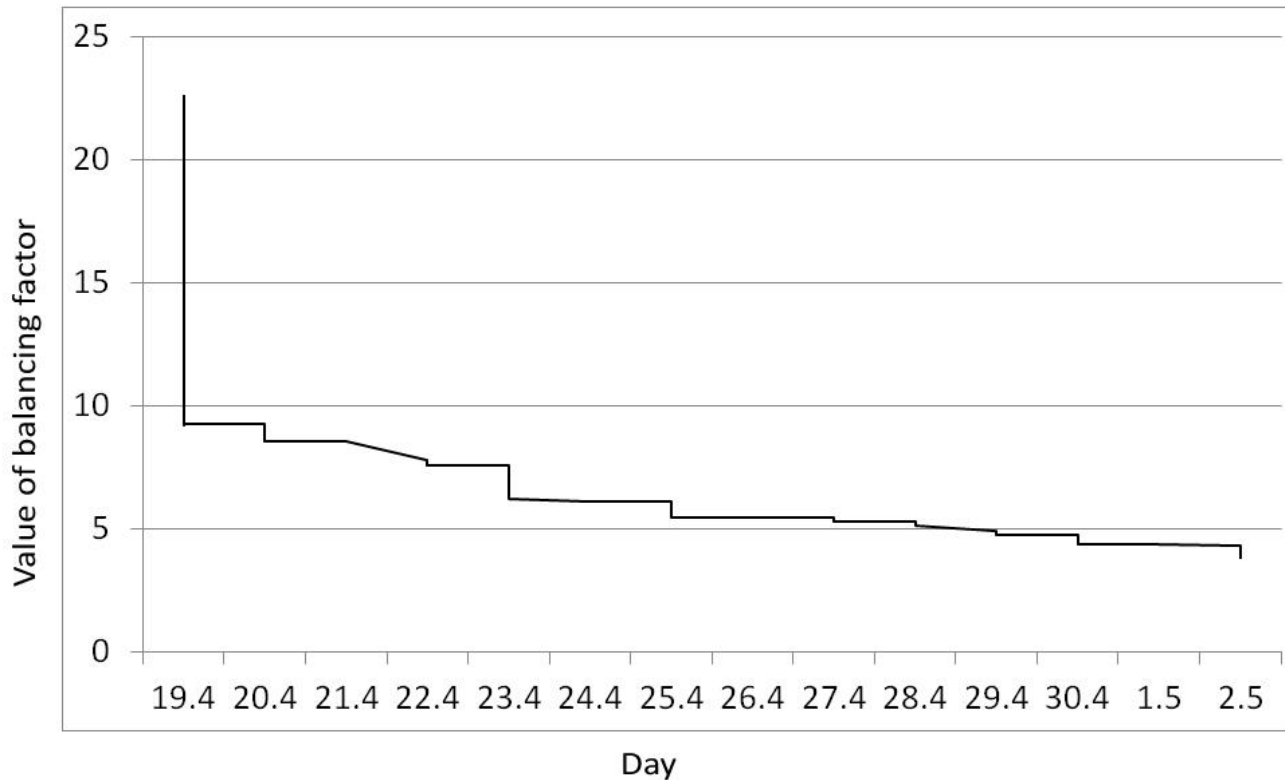
What is ideal balancing factor?

By the nature of our dynamic score computation method balancing factor **should converge to the value of 1** (if students would perform preferred activities)

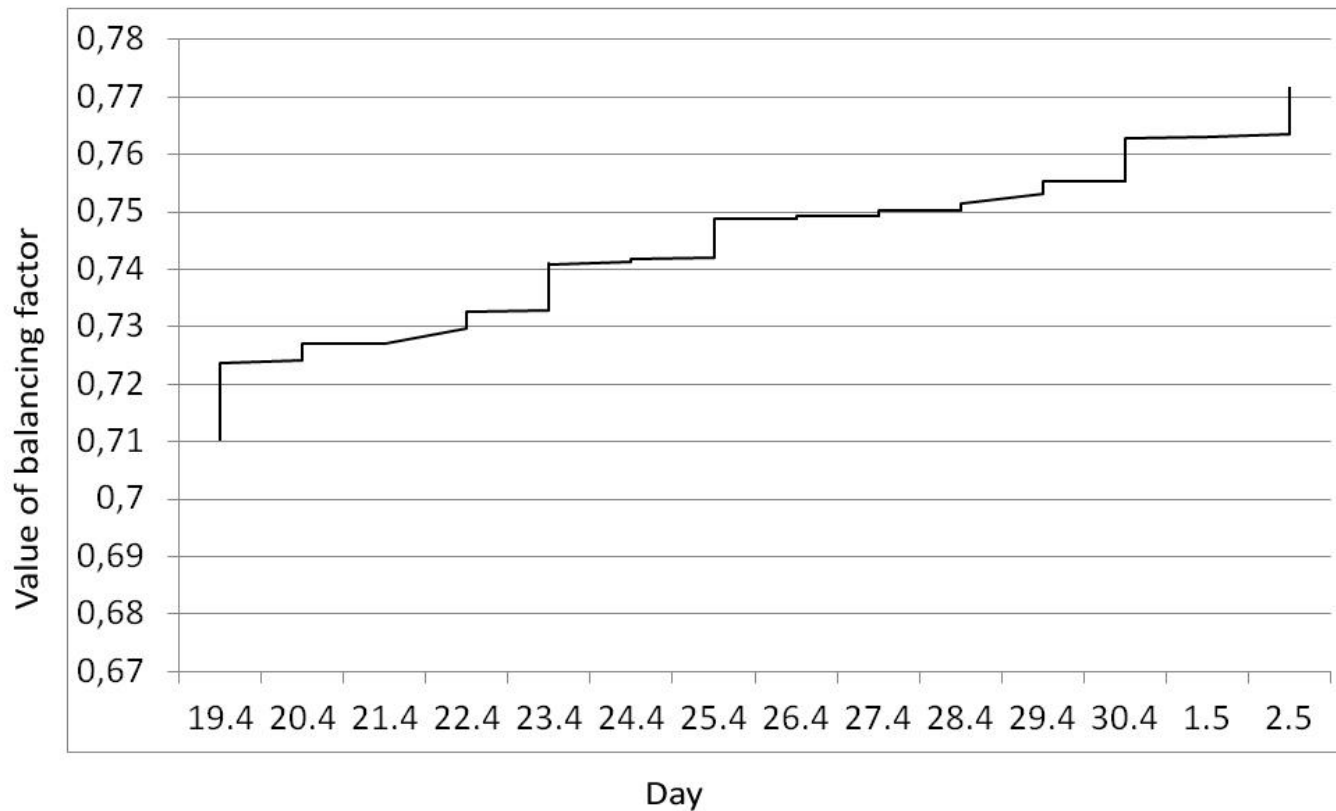
Activity type	Preference value	Activity type	Preference value
Comments	-	Bug reports	-
Highlights	-	External sources	4
Questions	2	Exercises	2
Explanations	-	Tags	3
Summaries	-	Question validator	4
Definitions	5		



Changes of balancing factor of the definitions



Changes of balancing factor of the questions



In most cases balancing factor converged to the ideal value of 1

WE ARE APPROACHING THE END

How good is the dynamic score?

Next step – personalization

- adaptation not only to the activity of students' class but also to particular student knowledge (activities on the content not mastered well are more valuable)