SimSE Educational Game A:
Estimation Planning
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Audience: Students

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1. Introduction/Background

This SimSE game teaches players how to select estimation team members based on the skills required to perform the statistical steps involved in building a linear regression model of the size–effort relationship. The game requires the player to choose an employee whose skills match the dataset of software projects being analyzed. The player must also analyze possible combinations of analysis steps and select among ten alternative sequences for constructing a linear regression model using the dataset. Through this process, the game illustrates to students that the sequence of steps for building a linear regression model may vary depending on the characteristics of the dataset, such as when software size information is missing or when statistical outliers are present.

2. How to Use This Module

This module is designed to be used as part of a course on software project estimation within a course in software project management.

SimSE is intended to be used as a *complementary* component to a course, not as a standalone instructional tool.

Since the estimation approach used in the educational game is based on software functional size in Function Points, software functional size measurement in general should be introduced to students either before, or in parallel with the students' exposure to the game (either through lectures (see Section 6), readings (see Section 7), or some other method).

Before students are given the assignment to play a SimSE game, it is imperative that they watch the SimSE Gameplay video tutorial. It is strongly recommended that they also watch the Explanatory Tool and Game Branching video tutorials as well. All video tutorials are available at http://www.ics.uci.edu/~emilyo/SimSE/downloads.html#Videos.

Our experience with SimSE has shown again and again how crucial the instructions a student receives in learning to play the game are to their success in learning from it.

These video tutorials have been designed to specifically highlight and address aspects of SimSE that are critical for students to understand for a maximally effective educational experience. Therefore, we suggest that you not only assign the students to watch these videos on their own time, but, if time and resources allow, show them in class as well, emphasize how important they are to watch, and also point them to the SimSE player's manual, available at http://www.ics.uci.edu/~emilyo/SimSE/downloads.html#Docs.

If time and resources further warrant, students should be required to attend a teaching-assisted (TA) -lead training session, in which they are shown the videos, given a printed player's manual and, and then allowed to try playing the game for a while with the Teaching Assistant (who should have already studied the manual and played SimSE themselves) available to answer any questions they may have.

Students should be given the questions to answer for this module (see Section 8) at the time they are asked to play the game. Having the questions to refer to while they play helps point them to some of the more subtle lessons encoded in the game, as well as provides you, as an instructor, with a way to assess whether or not they have completed the assignment and learned the concepts.

One could use this module as a mandatory part of a course, or else make it an extra-credit assignment. Given that the exercise is actually quite involved, especially when multiple models are assigned, somewhere in the order of 5-10% extra credit is recommended. Certain prerequisites for this particular module apply (see Section 4).

3. Learning Objectives

The learning objectives are from a software management and statistical analysis perspective. The following three game-specific learning objectives are implemented in this SimSE game:

- *The students should know that some steps in building a linear regression model may be repeated multiple times.* When datasets with different characteristics are used for a statistical regression analysis, there may be a different sequence of steps: for example, the identification and removal of statistical outliers before a regression analysis may require several iterations.

- *The students must take into account a) the type of data sets used; b) the necessary employee skills for the datasets selected, and c) the related salaries, to complete the statistical activities within the given budget.* For example:

    - For a data set of in-house software projects for which the software size in Function Points is not available, the measurement of their software size in Function Points is required before proceeding to a linear regression analysis.

    - Such a measurement step is not necessary for the ISBSG dataset which already has for all projects their size in Function Points.

- For each employee in a game, their salary depends on their set of skills. The students need to figure out what sets of skills is necessary for the selected datasets to complete the activities within the budget constraints.

- *Two kinds of skills have different levels of impact and should be evaluated differently.*

    - For the measurement skill: the employee either has it or not.

    - For the statistical skill: there are three levels of skill which influence both the salary and the speed of measurement.

    - Students must consider both types of skills when selecting an employee and figuring out their impact in a game.

4. Prerequisites

A student (a game player) should have a basic understanding of software engineering and management perspectives. (See Sections 6 and 7 of this document for ways to achieve this.)

For this game, players should have a generic knowledge of COSMIC functional size measurement (or another functional size measurement method). The main idea of this game is to take management decisions on resources selection and corresponding statistical analysis activities in a game.

5. Time Commitment

The average time to play a single game (e.g., a waterfall SimSE) is 10-15 minutes, but, of course, it is likely to take several iterations playing the game for the student to learn the concepts and be able to answer the questions. Players should be given at least one week of out-of-class time to explore the game and answer the questions (see Section 8).

6. Suggested Supporting Lectures

The book 'Software Project Estimation' - by Alain Abran provides good insights on statistical linear regression analysis in the context of software projects effort estimation.

7. Optional Supplementary Readings

1. Navarro, E.O. *"The Fundamental Rules" of Software Engineering.* 2008 [Available from: http://www.ics.uci.edu/~emilyo/SimSE/se_rules.html].

8. Assignment

Instructions

First, watch the SimSE video tutorials at http://www.ics.uci.edu/~emilyo/SimSE/downloads.html#Videos.

Then download the SimSE player's manual at http://www.ics.uci.edu/~emilyo/SimSE/downloads.html#Docs.

Be sure to watch the video and read the manual carefully, as they will highlight several important things that will significantly help you in successfully playing SimSE and correctly answering the questions.

Next, download the Measurement game at https://chairegestionproduitsprojetslogiciels.github.io/simse-software-estimation-capability/games/game-a-estimation-planning.html#downloads. The download consists of a "readme" text file and an executable game, which you can run by simply double-clicking on it. If you do not have the current version of Java installed on your machine, you will have the opportunity to install it when you try to run a game.

Questions

We recommend choosing two to three of the following questions with this module.

1. When doing a statistical regression analysis of software projects using software size as the independent variable, what is a key difference between in-house projects and the projects available in the ISBSG dataset – (ISBSG: International Software Benchmarking Standards Group – isbsg.org)?

2. If the player selects the ISBSG dataset and also chooses an employee with a Function Point measurement skill, will it decrease-increase the game score?

3. How to make the decision on choosing an employee with a fair level of statistical skill or a top level of statistical skill?

4. Why the sequence of steps for a statistical a linear regression analysis may vary?

9. Other notes

There are several other potentially effective uses for SimSE, most of which have yet to be fully explored:

- Have more advanced students modify an existing model (or build one from scratch, which should only be used with extremely advanced students) using SimSE's Model Builder tool and one of the existing models (available at http://www.ics.uci.edu/~emilyo/SimSE/downloads.html).
    - This has been tried, and results published in T. Birkhoelzer, E. Oh Navarro, and A. van der Hoek. *Teaching by Modeling instead of by Models*. Sixth International Workshop on Software Process Simulation and Modeling, May 2005 (available at http://www.ics.uci.edu/~emilyo/papers/ProSim2005.pdf).
- Our experience has suggested that an observer presence can have a positive effect on learning in SimSE. Although we have not tried this ourselves in classroom settings (only in controlled experiment settings), some suggested ways to try this are having students play SimSE in pairs or having them play SimSE in a lab setting while observed by an instructor or TA.
- Have students play in teams, especially teams that have also done, or are doing, a class project together. This can add both a collaborative aspect to learning and, if set up to be a competition between teams, can add a competitive aspect.
- Make the assignment mandatory, rather than optional or extra-credit, to increase motivation.
- Have students play in a lab setting, both to add a competitive aspect and to allow them to collaborate.
    - Keep in mind, however, that a lab setting generally does not provide enough time to play a game enough to be able to answer all the questions.
    - An appropriate approach might be to allow students to play the game first in a lab session (this would also allow them to ask any questions that may arise) and then let them complete the rest of their playing and question-answering out of class.
- If a project is also being done as part of the course, have students pick one or more of the SimSE models and write an essay on comparisons between the SimSE process model(s) and the one followed in their project.

10. Feedback?

If you have any comments, suggestions, feedback, or experience regarding this course module or SimSE in general, please send an email to Alain Abran<Alain.Abran@etsmtl.ca>

References

1. COSMIC. (2020). Early Software Sizing with COSMIC: Practitioners Guide.

2. COSMIC. (2020). Early-Sizing-Experts-Guide-May-2020-1. https://doi.org/10.13140/RG.2.1.4195.0567

3. Abran, A. (2015). Software project estimation: The fundamentals for providing high quality information to decision makers. *John Wiley & Sons.*