A Case Study to Evaluate the Use of i* for Helping Pedagogy Transparency

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Abstract. Pedagogy Transparency is a quality driven concept built from the junction of the new pedagogy movement, based on Vygotsky´s social interactionist theory, and the notion of information disclosure. Pedagogy Transparency aims the disclosure to students of how they are being taught and why, as to improve their awareness about the learning process. We present a study conducted to evaluate three pedagogies strategies: a traditional one, one applying games, and another applying a combination of games and *i** models. The results show that there are gains in applying new pedagogy strategies, in particular the one that is more akin to the concepts of Pedagogy Transparency and uses *i** model as a way of information disclosure.

Keywords. iStar, Transparency, Pedagogy

1 Introduction

According to [1] pedagogy is "*study of teaching methods, including the aims of education and the ways in which such goals can be achieved*.", or according to [2] "*Pedagogy is more than the accumulation of techniques and strategies: arranging a classroom, formulating questions, developing explanations, creating a curriculum. It is informed by a view of mind, of learning and learners, of the kind of knowledge that is valued and above all by the educational outcomes that are desired*." In a previous work we have presented the initial ideas of pedagogy transparency [4], which were further elaborated by Monsalve´s Ph.D. thesis using the ideas of modern pedagogy [13], Freire´s ideas [14], game base learning [6], and software transparency [5].

The general idea of pedagogy transparency is that, if students are told of how they are being taught, this may work in their benefit as to gain more knowledge as they become more aware of the teaching process, and as such have a more effective learning. In [4] we have posited that i* [3] would be an enabler of transparency once used as an add-on to a game base learning strategy. The question we had formulated was: "*what is the potential of i* as an enabler of pedagogy transparency? ",* which was further developed to propose a hypothesis: “*Operationalization of Pedagogy Transparency by means of i* models and game base learning improves the learning process in software engineering education*”

The purpose of this article is to present the results of a case study, which provided evidence for the confirmation of the above hypothesis. As such, we provide a brief introduction to the game base learning strategy we have used and the role of i* in improving transparency.

2 Objectives of the research

The aim of our research is to explore the effectiveness of intentional models when they are used with game base learning in order to improve the learning experience. This idea was introduced in [4], which described that i* models would be used as way to provide transparency for a game-based learning (GBL) strategy, in particular of its internal workings. That is, not only the game is used to enhance learning, but the game itself will be disclosed to the students (users) to inform them of how it achieves its goals.

3 Scientific contributions

3.1 Transparency Pedagogy

Our approach to teaching uses a vision anchored in the principle of transparency as information disclosure [5]. Transparency in pedagogy emerges as an important issue which aims to make the learner aware about his/her teaching-learning process and content production [4]. That means, from the perspective of pedagogy, transparency seeks an environment where goals are open and teaching methods aim consensus by focusing on learner participation and feedback arising from his/her participation.

3.2 SimulES-W

SimulES-W [12] is an evolution of the Problems and Programmers (PnP) game [7]; it aims at teaching software engineering process in a collaborative way, where a player covers the role of software project manager and this player has to deal with: budget problems, software engineers employment, and building of artifacts, all of that within the requirements of the project. Moreover, the player has to submit problems to other players, adversaries, to damage their game. SimulES-W has different rounds where players execute their moves such as: Start, Concept and Manage problems, Actions (Build, Inspect or Correct artifacts and integrate artifacts into a module), and Submit product.” [4]

3.3 Game Based Learning with i*

It has been argued that i* contributes to software transparency [8], [9] by means of satisficing characteristics that contributes to software transparency. For instance, i* contributes to conciseness, which contributes to understandability [5], since it provides a well defined organizational structure (actors, agents, position, roles), as well as goals, softgoals, tasks and resources. Since i* models allows links to the "real world", by means of actors, we consider that these models operationalize verifiability and traceability, characteristics associated with auditability which helps transparency. As actors in i* are organized in roles and positions, "*i* helps to identify the link from a position to a role*" [9], we understand that the models are providing an operationalization for clarity, an informativeness characteristic that helps transparency. By using roles, i* models also provide a way of attributing responsibility, and, as such, operationalizing accountability, an auditability characteristic that helps transparency [5].

We examined these attributes from the perspective of game base learning [6]. As such, we have noticed that the organizational structure of the game is easily depicted, since it was observed that students had no difficulty reading the models and associating the actors with reality, thus achieving traceability (see Figure 1 for an example of one such model). Perception studies in GBL indicate that the effectiveness should be analyzed trough how students see the game reality [10]; we observed that i* models can help clarity by exposing positions and roles, and as such providing a map of game reality. This correspondence with reality is also studied in [11], that is: how the GBL application can assist the students and whether confusion is experienced. Actor taxonomy provided by i* promotes clarity by identifying responsibilities (roles), and as such operationalizing accountability, that is: who are responsible for which tasks.

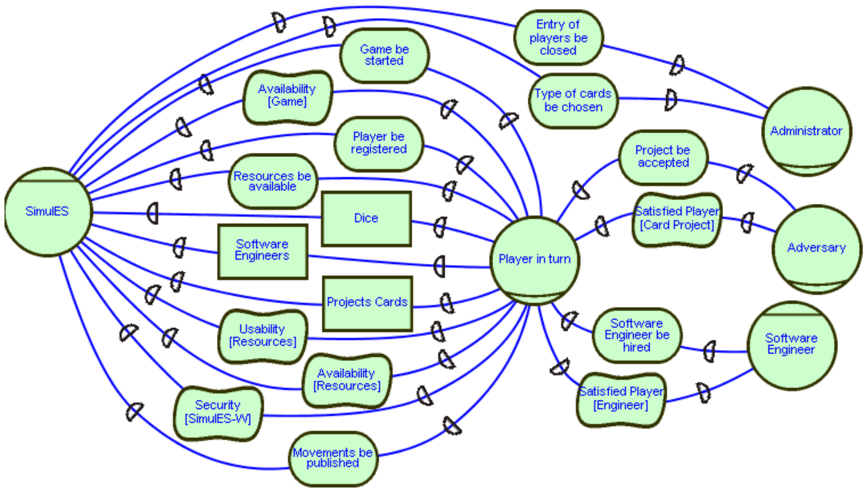

Figure 1 – SDsituation: Play round to start (from [4])

3.4 Case Study

The case study was designed to be applied on three different groups: (i) Traditional Lecture: Concepts were taught in a traditional lecture. (ii) SimulES-W: This group was taught using SimulES-W, (iii) SimulES-W with i*: This group had in advance the information of the inner workings of SimulES-W by receiving (reading) i*models of SimulES-W. The set of i* models was comprised of 12 models, each representing an SDSituation [15], which is a modular strategy for building i* models. Group formation was random (students were selected by a drawing).

This case study took place in the last half of 2013, with 26 students enrolled in a software engineering course at UERJ´s (State University of Rio de Janeiro) Computer Science Undergraduate Program. The study was accompanied by a pre-test, post-test and exam. Therefore, our aim was to obtain answers that could verify our hypothesis -- "Operationalization of Pedagogy Transparency by means of i* models and game base learning improves the learning process in software engineering education" --.

Post-test was conducted by a qualitative questionnaire. It was designed to detect how the students perceived the strategy applied in his/her case, as well as to confirm overall understanding of course material. Answers were examined and graded by the first author in a three point scale. Results point out that performance of the groups with SimulES-W were better, being the case that when asked to map the concepts learned with reality, the group with SimulES-W and i* models had the best performance. It was also observed that the students belonging to this group were the most motivated and participatory.

Table 1 shows the grades of the course exam for each group in quantiles (the data values marking the boundaries between consecutive subsets). The minimum score was obtained in the lecture group (3,5) and the maximum was obtained both in Lecture and in the SimulES-W with i* group. Meanwhile, the median shows that SimulES-W with i* got a little better performance than the other groups. The mean, in Means and Std Deviation part, has values as follows: SimulES-W with i* (7,75), Lecture (7,5) and SimulES-W (6.5). These differences are too small to posit a strong result, but results are promising, since there was no negative effect in using the proposed operationalization (game and i*).

Quantiles

Level	Minimum	10%	25%	Median	75%	90%	Maximum
Lecture	3,5	3,5	5,5	8	9,25	10	10
SimulES-W	5	5	5,625	6,5	8,5	9	9
SimulES-W iStar	5	5	5,75	8,5	9,25	10	10

Means and Std Deviations

Level	Number	Mean	Std Dev	Std Err Mean	Lower 95%	Upper 95%
Lecture	5	7,5	2,42384	1,084	4,4904	10,51
SimulES-W	9	7,02778	1,49188	0,4973	5,881	8,175
SimulES-W iStar	8	7,75	1,85164	0,6547	6,202	9,298

Table 1. Exam Results

A T-test (Figure 2) was conducted to examine the hypothesis with confidence interval of 95%, it was applied to each two groups. Comparison of SimulES-W with Lecture has a t-Ratio of 0.267 for the Prob < t of 0.603. SimulES-W with i * comparison with SimulES-W has a t-Ratio of 0.610824 for the Prob < t of 0.7251. Comparison of SimulES-W with i * Lecture has a T-Ratio of 0.790493 for the Prob < t of 0.7796. In short, this indicates that the comparison between SimulES-W with i *and Lecture provides a strong indication that the operationalization of transparency by game based learning with i* becomes more effective pedagogically than just the Lecture.

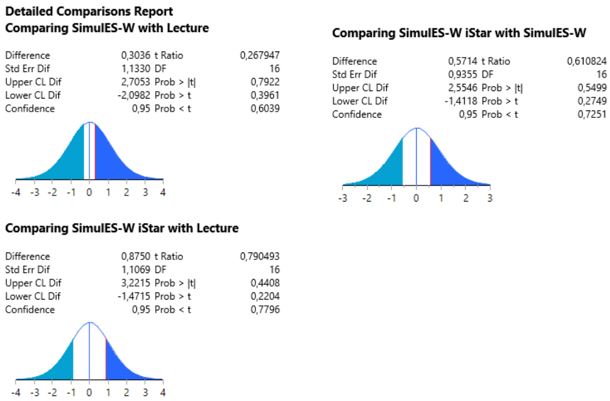

Figure 2 – T-Test

We also observed that the SimulES-W with i* group adapted quickly to the activity and obtained better performance when using the game. We also observed, that if compared to the group who played, but did not use the models, the SimulES-W with i* group felt more confident in performing the actions within the game.

4 Conclusion

The challenges proposed by the idea of transparent pedagogy are yet starting to come through and must be accompanied by teaching methods that are consistent with these characteristics. The case study provides evidence that, using an intentional modeling for disclosure of the game inner workings helps the operationalization of Pedagogy Transparency. However, although the results showed that this operationalization helps a better understanding and performance of the students, it is also a fact that the case study has several situations that could be seen as threat to validity, including: size of class, depth of teaching material, and election of participants, among others. Notwithstanding, by using a pre-test, a post-test, and an exam, together with a observation of activities we believe that our results do provide useful feedback in the study of learning strategies with information disclosure.

5 Ongoing and future work

Future work will be centered in better evaluating the effect of conceptual models towards pedagogy transparency in general. We will also continue to explore the connection of game base learning with conceptual modeling, in particular of intentional modeling using our case study framework. Although it demands a large investment, we are confident that the repetition of our case study is an important path to be followed, not only to collect more data, but also to improve the case study framework as well. On the other hand, studies focusing on more detailed observation of the use of i* as reading material are necessary. These studies should help the evolution of our framework, as to provide better arguments of why intentional modeling, instantiated by i*, is an important player in providing software transparency.

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