Using i* for Transparent Pedagogy

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Abstract. Pedagogy, "the principles and methods of instruction" (Wordnet), implies a relationship among actors playing the roles of teacher and student and has a direct impact on the students' learning performance. In the past, the teacher was a transmitter of knowledge and the student a passive receiver. Nowadays, students are encouraged to challenge, deepen and create their own knowledge and teachers are supposed to lead this process. For that reason, transparency emerges as an important concern that aims to enhance this relationship by improving student awareness about the process and the contents of learning. The purpose of this research is to address the potential of i* within pedagogy transparency. We discuss the role of i* models as providing transparency for a game-based learning (GBL) strategy.

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*." As such, it can also be seen as a relationship between actors who have interpersonal contacts aiming the transfer of knowledge. In a broad sense, this relationship has a direct impact on a students' academic performance. For that reason, transparency is important [10], as to enhance students' awareness and their commitment towards learning [3].

The purpose of this article is to explore the question: *what is the potential of i* as an enabler of pedagogy transparency? As such, we discuss the role of i*[5] models as providing transparency for a game-based learning (GBL) strategy, focusing on a specific setting: Software Engineering Education by means of a GBL strategy.* In particular, we narrow down the general question by a first investigation of a specific situation: SimulES-W [4] as the implementation of the game.

Proposals for GBL in Software Engineering are being reported by different researchers [9]. Although there are positive evaluations for GBL [15], there is still lack of evaluations on the effectiveness of these strategies in SE. Our first experimental results [14], based on the application of tests to different groups, those which played and those who did not, shows that SimulES-W has a positive pedagogic effect. On the other hand, we also have experience in opening the game for students as an open source project. This gave us an insight that the software that implements the game provides an extra leverage if students can understand it. Since we have been working on software transparency [13], we decided to explore the transparency of SimulES-W as way of implementing pedagogy transparency, enabling students to better understand the inner workings of the game.

SimulES-W is a digital game used to teach software engineering [4], this game allows the players to play in a collaborative way. During the development process of SimulES-W the approach used was to base the requirements on the representation of intentionality between players. The resulting models were used to generate the implementation and to show how the game works not only from a technical approach but also from the point of view of the actor's intentionality. Using i* models we aim to show students how the game works from a conceptual modeling standpoint.

2 Objectives of the research

The aim of our research is to explore pedagogy transparency in the context of GBL, using the SimulES-W game. Pedagogy transparency [10] is a new concept not yet fully developed. The general idea 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. Given that we have explored the potential of i* towards more transparent models [11], by means of our transparency conceptual model (accessibility, usability, informativeness, understandability and auditability) [13], we conjecture that i* models maybe a way of providing pedagogy transparency. As such, i* models will be used as way to providing transparency for a game-based learning (GBL) strategy, in particular of its own 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.

Through SimulES-W, we will explore how i* models could provide support to the non-functional requirement of transparency [11, 13] as to be a means to disclose the inner workings of the game. We used a strategy that derives i*models using the Intentional Requirements Engineering method (Eri*c) [7]. The strategy uses, as a starting point, a lexicon [6] describing the vocabulary of the application. Intentional models are later on mapped to a MVC based architecture and to the source code.

Although the general question is how i* could enhance pedagogy transparency, we will study the question within a particular case of a multi-player, collaborative game. Our evaluation will be based on testing students using two different groups: a) students with exposure to GBL, and b) students with exposure to GBL and the GBL i*

models. Note that our proposed protocol will evaluate the use of i* as an enhancer of pedagogy, by providing some level of transparency. We will not compare i* models with other types of models for the same task. Central to our evaluation will be the question of the transparent rationale as an incentive to more effective learning, by leveraging student's awareness.

3 Scientific contributions

3.1 SimulES-W

SimulES-W is an evolution of the Problems and Programmers (PnP) game [12]; 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.

3.2 The Modeling Process

SimulES-W [4] was developed using ERi*c [7], a method which uses i* as the main modeling language. ERi*c has 6 parts, interconnected by a bus (requirements baseline) through which they interact. The parts are: goal and actor elicitation, SDsituations identification, goal modeling for each actor, rationale modeling for each actor, Sdsituations specification, and analysis of SD and SR models. Strategic Dependency Situations (Sdsituations) identifies goals arrangements interconnected in order to implement how goals should be composed to set context dependency situations. Figure 1 portrays the SDsituation for the SimulES-W, which shows each round of the game. The rounds are named: Play round to start, Play round to actions, Build artifacts, Inspect artifacts, Play round to concepts, Managing problems, Submit product and Integrate artifacts in a module. Also, Figure 1 illustrates the time ordering required between rounds. Each round has its corresponding SD and SR Diagrams; Figure 3 illustrates one of them. Figure 2 describes the different actors, agents, roles and positions involved in the game, as seen from the software, informing the different types of actors and their instantiations.

3.3 Mapping Heuristics

SimulES-W is based on a MVC (Model-View-Controller) pattern to separate the business logic, interface, and control. Similar to the work presented in [8], we have devised a way of mapping i* models to an MVC architectural level description, which is described in [4]. This architecture is then reflected in the game´s code.

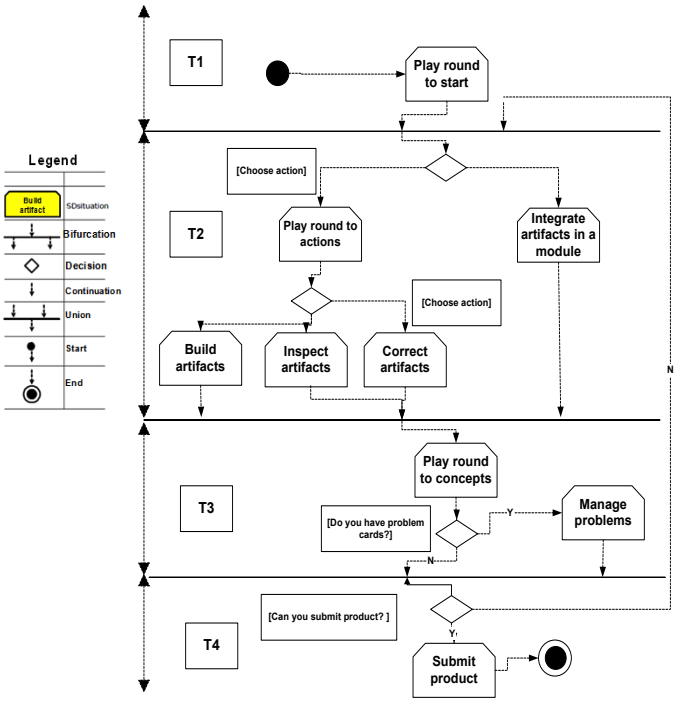

Figure 1. SDSituations Diagram [9].

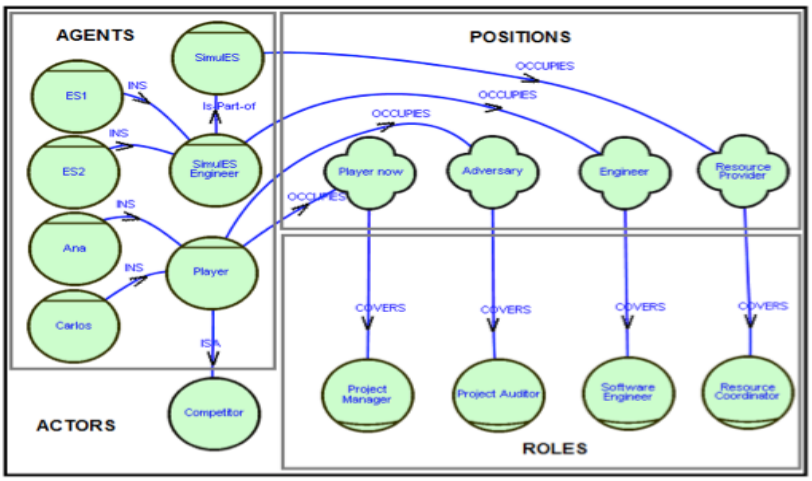

Figure 2. The SA Model for SimulES-W [9].

3.4 i* models as providing transparency for a game-based learning (GBL) strategy

If, in the process of helping learning, GBL becomes more transparent, we infer that the Pedagogy being used, will be more transparent; making the students more aware

about their learning process. As we can see from Figure 2, the reader of the model will be informed of the position "adversary" as being occupied by the agent "player", and that this position covers the role of "project auditor", and in Figure 3 the reader will be informed that the goal "project be accepted" depends on the position "adversary". In our transparency conceptual model [13], accessibility, is one of the qualities "helping" transparency. Providing access to the information (disclosure), via models, we are contributing to transparency, but, of course, the presence of other qualities will enhance transparency even more. The models produced are used as a way of showing how the game works, allowing the interested student to know how a GBL strategy is implemented. As such, the student will have access to how the pedagogy (GBL) is working. Section 2 described a general approach towards evaluation, based on tests. However, to better understand the results we have to consider levels of transparency (given that the concept is multi-faceted). As such, we will need a survey instrumented with questions to elicit the perceived level of transparency given our model [13], but also taking in consideration pedagogy [2, 3, 10].

4 Conclusions

We understand that transparent pedagogy involves characteristics as already mapped in [13], but we need to explore it further in the context of GBL. As we explore the frontier of transparent pedagogy we plan to continue to use i* models as base for the disclosure of information about the game and also regarding the context in which the learning takes places. Of course our models will evolve along the preparation for the experimental study, as we learn more about transparent pedagogy.

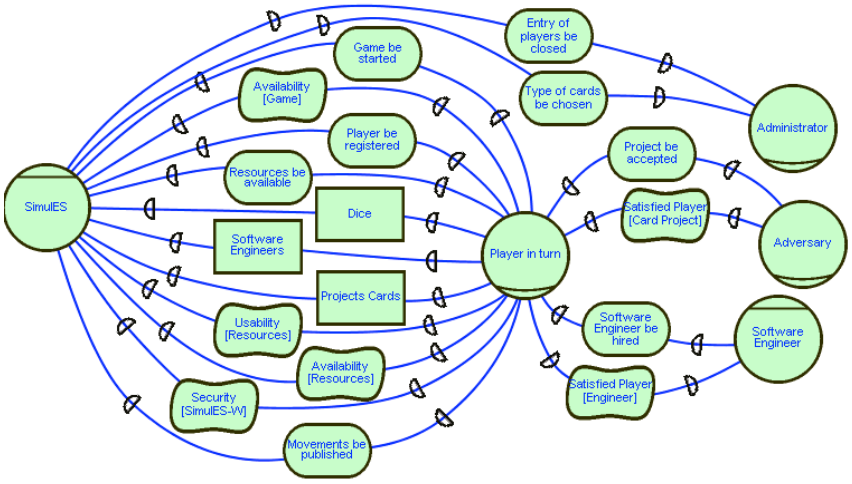

Figure 3. SDsituation: Play round to start.

5 Ongoing and future work

We are starting to understand transparent pedagogy in the context of GBL evaluation for software engineering. We will use a survey approach, which should blend transparency with more knowledge of pedagogy transparency. This work will stand upon early work on the game evaluation [9, 11], which uses both qualitative and quantitative questionnaires, in order to build an evaluation mechanism to understand the role of conceptual models in supporting a transparent pedagogy. As our results become available we will be in a better position as to infer the implications of the results towards the question of how intentional models may help pedagogy transparency.

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