Gamification of Business Process Modeling: A Board Game Approach to Knowledge Acquisition and Business Process Modeling with BPMN

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ABSTRACT

Gamification of learning, the application of game design elements to learning activities, has increased over the last years, due to its potential to enhance learning. Following this assumption, we developed a board game in the style of a "wheel of fortune", which is known to most people from television or trade fairs. The content of the wheel refers to the modeling language Business Process Model and Notation (BPMN). The basic idea of the BPMN wheel game is that players learn basics about BPMN and these can apply practically. The board game is suitable for a lecture in universities or enterprise trainings. The prototype was tested and evaluated in the course 'Business Process Management (BPM)' of the bachelor's program 'Digital Business' at Technische Hochschule Ingolstadt.

This contribution should be considered as work in progress.

KEYWORDS

Gamification, Business Process Management, board game, BPMN, Game Based Learning, knowledge acquisition, knowledge transfer, process modeling

1 Introduction

Playing games fascinate people. If people are observed during a game session, an ongoing motivation is remarkable. Huizinga defined gaming as an activity, which is carried out completely free without constraint, and where the human feels pleasure [1]. Hence, gamification, defined as "the use of game design elements in non-game contexts" [2] has become a popular method used to foster human motivation and performance in regard to a given activity. Given this potential, the idea of using the motivational power of games for the learning context is reasonable. The ultimate goal of teaching is to foster learning. Gamification is a relatively new approach that has shown a potential benefit to learning [3]. Gamified approaches overcome demotivating factors that could make learning more difficult or even impossible. Based on the concept of gamification, we developed a board game as a kind of wheels of fortune to increase learners (learning) motivation to acquire (new) knowledge in the field of business process modeling. We also aim to improve the model quality of business processes. Using the board game we intend to answer the following research questions in this article:

RQ1: Can the use of gamified solutions support knowledge acquisition and knowledge transfer in the field of BPMN?

RQ2: Can gamification improve the model quality of business processes?

The developed board game is not intended to replace a whole course, but to be embedded into an interactive teaching part.

2 Concept and Implementation

2.1 Game design elements

2.1.1 BPMN wheel game content

The BPMN wheel game was developed with the learning matter 'BPMN' [4, 5 and 6]. Players can get an overview of the modeling language BPMN and practice their knowledge by modeling a business process.

2.1.2 BPMN wheel game design

The core of the board game is the BPMN wheel and another wheel for the collection of notation elements needed for process modeling. The BPMN wheel contains 14 fields consisting of four field types called learning cards, control question cards, teamwork and notation elements wheel (see figure 1). The notation elements wheel (second wheel) includes also 14 fields for collecting the usual notation elements, e.g., activities and events (see figure 2). The number of fields per field type was adjusted after a real test to influence positively the game flow. Thus, there is an uneven distribution of the total number of fields to the field types.

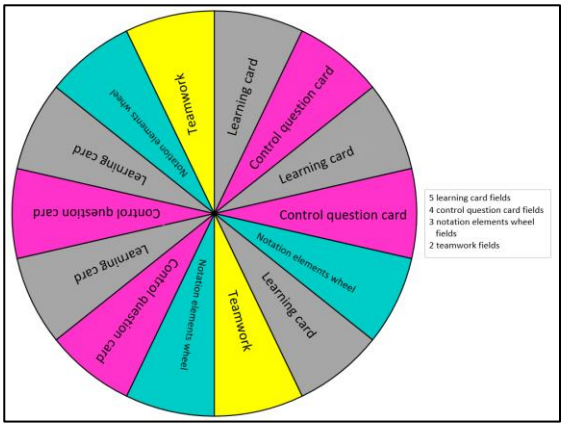

Figure 1: BPMN wheel

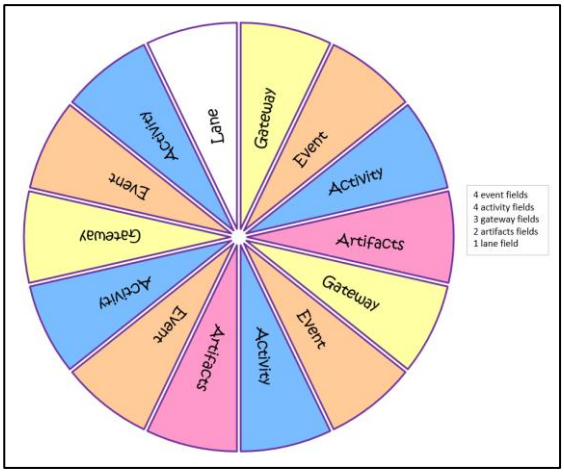

Figure 2: Notation elements wheel

2.1.3 Elements for knowledge acquisition and process modeling

- Learning cards and control question cards

We created 40 learning cards of the same color for the theoretical learning content needed for process modeling. We defined headings for the information printed on the learning card. This should support players by structuring the learning matter.

- Control question cards

20 same-colored control question cards should query the theoretical learning content and support the learning process. Questions of various types, i.e., open and closed questions, are placed on the

front of the control question cards. Students can see the answer of each question on the backside of the control question card. Players get coins as a reward for correct answers. The color of the coin, which can be collected by answering a question correctly, is printed on the front of the control question card. Collected coins can be redeemed for (missing) notation elements afterwards.

- Notation elements

We prepared moderation cards for the different notation element types to enable business process modeling. For that reason, a game set includes cards for activities, events, gateways, data objects and lanes. These can be collected throughout the time of playing. Collected cards can attached on presentation paper during the time of teamwork.

2.1.4 Game mechanics

In order to motivate players and catch the attention of the different player types Bartle identified [7, 8 and 9], we implemented a set of 14 game mechanics, i.e., badges and clear goals. The following table lists some selected game mechanics and their implementation in the BPMN wheel game.

Table 1: Game mechanics and their implementation

Game mechanic…	… and how it is implemented in the game
Badges	The winning team is crowned as an expert team in the modeling with BPMN.
Clear goals	Correct modeling of the business process.
Customization	Players can select and arrange notation elements as desired.
Epic Meaning	Each player contributes to the team success.
Quests	Control questions of different question types as well as modeling of the business process.
Transparency of results	Players know the color of the coin they can collect.
…	…
…	…

2.2 Prototype and Playing

We implemented the prototype according to the concept discussed above. Figure 3 illustrates the elements of a BPMN wheel game box.

Figure 3: Content of a BPMN wheel game box

In the game are two phases: the learning phase and the modeling phase. In the learning phase, theoretical basics are learned and questions are answered related to BPMN. In the modeling phase, the theoretical contents learned are implemented by attaching the collected notation elements to the moderation paper.

The gameplay looks like this: Students organize themselves in teams of 3-4 people. The teams get a modeling task in form of a verbal description. The board game is played clockwise. The players follow the instructions related to the 'rotated' fields (see table 2 and table 3). The winner team is the team who has modeled the business process with fewest errors within the given time slot.

The following table lists the fields and the actions to be taken on the field.

Table 2: Description of the fields on the BPMN wheel

Field	Instruction
Learning card	Draw a learning card and read the information aloud.
Control question card	Draw a question card and read the question aloud. Try to answer the question. Your team members can support you, if you are not able to answer. Check the answer printed on the backside. The color of the coin, which can be collected by answering correctly, is printed on the front of the control question card.
Notation elements wheel	Turn the notation elements wheel and follow the instruction (see table 3).
Teamwork	You should model the process with the collected notation elements in 3 minutes. Collected coins can be redeemed for missing notation elements now.

Table 3: Description of the fields on the notation elements wheel

Field	Instruction
Activity	Draw an activity card and label it according the textual process description.
Event	Pick a suitable event. You have the choice between a start event, an intermediate event and an end event. Again, within these you have to choose the types, i.e., message event or timer.
Gateways	Choose from different gateways, i.e., event based gateway or exclusive gateway.
Artifacts	Collect artifacts, i.e. data objects.
Lane	Draw a lane card and label it.

3 Research Methodology and Results

We tested and evaluated the BPMN wheel game in the course 'BPM' of the bachelor's program 'Digital Business' at the Technische Hochschule Ingolstadt with 52 students. The course takes place

in the 3rd semester. The 52 attending students were divided in an experimental and a control group randomly. In the experimental group were 28 students, while 24 students participated in the control group. Smaller teams of 3-4 students were formed in each group. The teams of the experimental group played the BPMN wheel game, while teams of the control group got some selected literary extracts. The teams got for modeling the given business process a timeframe of 70 minutes. The control group had to return the literature at the beginning of the modeling part after about half the time.

In order to measure the learning success of both groups, we conducted identical pre and post knowledge tests. The test consists of a theoretical part and a modeling part. In the modeling part, the students had to model two small processes. Students could achieve 3 points for each question in the theoretical part. A student could achieve a maximum of 30 points (3 points x 10 questions) in the theoretical part. A student could score a maximum of 10 points in the modeling part. For the entire test, a student could thus get a maximum of 40 points (30 points + 10 points). The experimental group could score a maximum of 840 points (28 students x 30 points) for the theoretical part and 280 points (28 students x 10 points) for the modeling part. Accordingly, the experimental group could score a maximum of 1,120 points (840 points + 280 points) for the entire test. The control group could score a maximum of 720 points (24 students x 30 points) for the theoretical part and 240 points (24 students x 10 points) for the modeling part. Hence, the control group could achieve a maximum of 960 points (720 points + 240 points) for the entire test. Figure 4 and 5 demonstrates aggregated scores for both groups and the change of absolute numbers and relative shares.

Experimental Group						
Theoretical part	Pre test score	% of 840	Post test score	% of 840	Delta abs.	Delta rel.
	548	65,24%	618	73,57%	70	8,33%
Modeling part	Pre test score	% of 280	post test score	% of 280	Delta abs.	Delta rel.
	100	35,71%	114	40,71%	14	5,00%

Figure 4: Results of knowledge tests (pre and post) of experimental group

Control group						
Theoretical part	Pre test score	% of 720	Post test score	% of 720	Delta abs.	Delta rel.
	484	67,22%	550	76,39%	66	9,17%
Modeling part	Pre test score	% of 240	Post test score	% of 240	Delta abs.	Delta rel.
	109	45,42%	136	56,67%	27	11,25%

Figure 5: Results of knowledge tests (pre and post) of control group

From the results of the knowledge tests, the following findings can be achieved: Both groups have improved about equally well in the theoretical part of the knowledge test. It is noticeable, that the control group was significantly better than the experimental group in the modeling part of the knowledge test (pre). The control group was also better than the experimental group in the modeling part of the post knowledge test. This may be because the experimental group did not draw enough learning and control question cards for the practical modeling part. Instead, the control group had all the theoretical as well as the modeling information in more compact and structured form because of the literary extracts. In the modeling part of the knowledge tests, two smaller processes were depicted, dealing with specific gateways. Most likely, the teams in the experimental group did not draw the cards with this specific gateways used in the modeling part of the knowledge tests. Since both groups knew that process modeling was following, it may be that the control group has focused more on modeling. In addition, th groups knew that the identical

knowledge test would be carried out after the learning activity. Probably the teams of the control group have dealt with similar modeling examples or gateways more intensively. It is also possible that the control group has delegated tasks to the team members, so that each team member has dealt with a specific topic. The team members could have exchanged intensively. This would make it possible to gain deeper insights.

4 Conclusion and Directions for Further Research

We developed and evaluated a board game in form of wheels of fortune for the modeling language BPMN. The first experiences we gained were positive. The experimental group was able to acquire theoretical knowledge about BPMN and to reduce the errors in process modeling. Thus, the game has supported the knowledge acquisition and knowledge transfer in the field of the modeling language BPMN (RQ1). The practical implementation of the theoretical knowledge had a positive influence on the model quality (RQ2). Nevertheless, it is noticeable that the control group was able to acquire knowledge as well as improve model quality. This may be due to the reasons given in Chapter 3.

In order to measure the learning success more accurately, the same knowledge test was carried out after about 3 weeks again. This is to test the retention effect. It will certainly be interesting to compare these test results as well.

In order to consolidate our findings, we will conduct further evaluations with other student groups.

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