STRUCTURING COLLABORATION SCRIPTS

Optimizing online group work on classroom dilemmas in teacher education

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Author note

During CSEDU2014 the full paper as accepted will be available at the conference and through the first author. Our study will be presented and discussed with the audience by the first author. A shortened version containing the background, the essentials of the set-up and the main findings of the study is available in these conference proceedings. A revised, more extended and elaborate version of the paper will be under consideration for publication in a SSCI-listed journal, and we want to be careful about not violating copyright issues that might later arise when papers overlap substantially.

Keywords: serious games, scripted collaboration, structure, classroom dilemmas, teacher education

Abstract: The optimal structure in collaboration scripts for serious games has appeared to be a key success factor. In this study we compare a 'high- structured' and 'low-structured' version of a mastership game where teachers-in-training discuss solutions on classroom dilemmas. We collected data on the differences in learning effects and student appreciation. The most interesting result shows that reports delivered by students that played the low-structured version received significantly higher teacher grades when compared to the high-structured version.

1 BACKGROUND

Serious games not only support individual learning but also foster the acquisition of soft skills like collaboration and reflection about wicked problems, that are usually not addressed by other learning platforms (Gee, 2003). Workplace learning is shifting focus from individuals acquiring and updating domain knowledge towards selecting and using this knowledge for certain problem situations in daily practice where collaboration plays a crucial role.

Games are heavily inspired by experiential learning principles which hold potential for contextualised workplace learning. Serious games appear suitable as flexible learning environments where professional tasks can be carried out with little or no direct intervention of experts or teachers (e.g., Bell *et al*., 2008). How much erroneous or meaningful learning takes place will depend on the support that is provided, shared and distributed in the gaming environment. Collaboration support *within* a game has to be enabled by a didactic 'script' which we will name 'scripted collaboration'.

Collaboration scripts (Kobbe *et al*., 2007) are an instructional method that structures the collaboration by guiding the interacting partners online through a sequence of interaction phases with designated activities and roles. Such collaboration scripts have hardly ever been implemented and tested in more open learning environments like serious games (Dillenbourg & Hong, 2008). No research has focused on defining or optimizing the essential elements (e.g., of structure) or has measured the learning effects of including such scripting in serious game play.

Structure is defined here as the amount of restriction imposed on the freedom that is allowed in the group collaboration process. An optimal level of structure appears to be a key success factor for effective learner support. In a previous study we found that students complained about the complexity and task instruction within for the mastership game (Hummel *et al*., 2013). Building on Dillenbourg's (2002) risks of over-scripting we argue that *segmentation* and *inter-dependency* within the task constitute the main structure elements. An holistic task is less structured than a task that has been segmented in various consecutive subtasks; a task that can be carried out independently is less structured than a task that depends on synchronisation or approval of peers and / or teachers. We have further operationalized these structure elements and high/medium/low levels of structure for this study.

The Mastership game helps students to find solutions to the most prevailing practical classroom management dilemmas in a playful and collaborative way, a way that will help them become better teachers. The game was originally developed as a card game to be played face-to-face in small groups (Geerts, Mitzsche, & Van Laeken, 2009), and was later transformed into on online game to be played synchronously with freedom of place (Hummel *et al*., 2013).

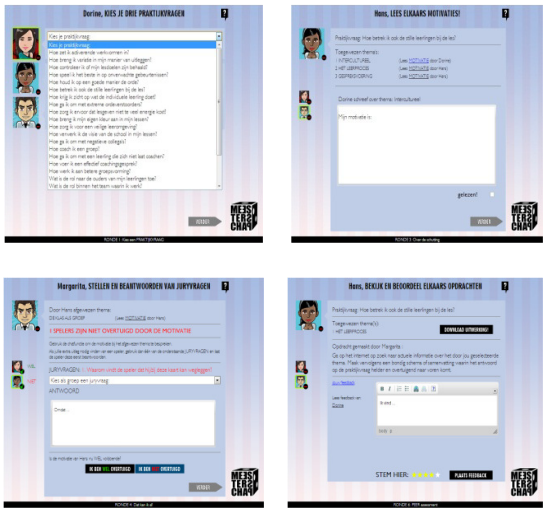

Figure 1. Screens of the online version of the Mastership game : selecting three practical dilemmas in phase 1 (upper left hand), assigning and motivating themes in phase 3 (upper right hand), motivating and discussing declined themes in phase 4 (lower left hand), and peer assessment of elaborated assignments in phase 6 (lower right hand).

The online Mastership game (for an impression see Figure 1) can be played in small groups of two till six students and does not require any intervention by teachers. After selecting their avatars, students start group play both in the role of player (or problem owner) and of co-player (judging the way that players solve their problems). The game has a structure that consists of five consecutive phases, during which players discuss, elaborate and negotiate solutions to solve each other's problems. Communication is structured by various assignments and rules during these phases, but is possible by unstructured group chat as well. During the *fifth phase* players select a practical assignment and use their co-players' input to further elaborate their solution in a short advisory report.

The main hypotheses (research questions) to be answered are twofold: (1) Will less structure lead to more 'natural' and effective collaborative learning?; and (2) Will less structure in the collaboration be appreciated more by students?

2 STUDY SET-UP

Third year students of the NHL University of Applied Science in the Netherlands participated in this case study as part of their regular curriculum. Participants are qualifying for a broad variety of first degree teaching positions, ranging from modern languages teaching, teaching didactics to science teaching. All students were approached by their teacher and invited to be present at a certain place and time at the university for a two-hour meeting. Participants were notified in advance that this meeting would also be used for study purposes, and were randomly allocated to one of three conditions (high-structured, low-structured, control).

Participants in the control group had to solve the practical classroom dilemma individually without playing the collaboration game. Each gaming condition contained two groups (of four or five students each). The players received an e-mail before the meeting, containing the URL and their personal account. All playing participants received a questionnaire about their appreciation of the game by e-mail a day after playing the game. At the time of the meeting, playing participants went to a computer room to work together online. A teacher was present in this computer room to control for direct (non)verbal communication beyond the program. During the time of the meeting, students in the control group individually worked on their practical task, without playing the game. For the

purpose of this study we included a *sixth* and final *phase* in which students had to grade the reports of their peers, in order to enable a comparison of the assessments by peers (co-players) and teachers**.**

To measure individual learning output, the quality of the solutions provided for the classroom dilemmas was assessed by using a *learning effect correction model*, that was developed by the topic expert. The elaborated reports can be assessed on 'growth in professional productivity', and the five criteria to establish this growth were inspired by the development of 'design practice' (or practical theory) (Copeland & D'Emidio-Caston, 1998): A. Ownership (to what extent does student commit to solve this problem); B. Reflection (to what extent does student reflect on his own actions); C. Focus (to what extent does student attach the right amount of context to the problem); D. Nuance / Complexity (to what extent is applying the solution feasible); and E. Richness / Correctness (of the elaborated solution). Sufficient inter-rater reliability of the instrument was determined in a previous study (Hummel et al. , 2013).

The *student satisfaction questionnaire* was developed for this study by a learning technology expert. It contains 19 items to establish the students' appreciation of various game aspects, pertaining to the structure (5 questions), user-friendliness and clarity (5 questions), the timing of the phases (2 questions), the quality of the dilemmas and assignments (5 questions), and the interaction during collaboration (2 questions).

3 RESULTS

We found that most individual reports (76%) could be graded as sufficient. The average grade for all participants was $M = 6.62$, $SD = 1.29$. We added a control group to establish if playing the game does contribute *at all* to learning. As you see in Table 1 the average teacher grades for the control group were indeed lowest, so there appears to be an effect of playing the game. This effect appears significant when we compare the non-playing group to the low-structured (t (18) = 2.97, $p < 0.01$) and the medium-structured condition (which we left out of the analyses). However, we could not observe a significant difference between non-players and those playing the high-structured version (t (17) = 0.67, p = 0.51).

Table 1. Average report grades for all conditions, both from teachers and peers

	High structure (n = 9)	Low structure (n = 10)	Control (n = 10)	All (N = 29)
Assessment	*M* *SD*	*M* *SD*	*M* *SD*	*M* *SD*
Teacher grade	6.44 1.59	7.35 1.03	6.05 0.93	6.62 1.29
Peer rating	7.93 .66	7.52 1.04	7.68 0.89	7.70 0.87

When looking for an overall effect of condition (N = 29) on learning effect we see a clear trend: low-structure scores best, than high-structure, and finally the control group. This effect is 'marginally' significant (F (2, 26) = 3.072, MSE = 4.428, p = 0.063, η_p^2 = 0.18), with values of the partial-eta-squared above .13 showing large effect size according to Cohen (1988). On top of this and even more importantly for the central research question, a significant difference (t (17) = 4,86, p = 0.042) is found in favour of low-structure when comparing with high-structure (N= 19). When looking at the peer ratings, we do not find any significant differences between conditions.

For most items in the student satisfaction questionnaire we did not find significant differences between both versions of the game, with just two exceptions. The low-structured group showed to be more satisfied with the amount of time to play (item 16). The high-structured group indicated that the overall structure was too high (item 11), a finding in line with what was reported on learning effects. It did not become clear that low-structure was appreciated more by students on various aspects.

We may conclude that collaboration can be successfully facilitated by scripting serious games when we take into account the importance of good instruction and optimal structure. This study found that over-scripting may indeed have disruptive learning effects. Players of the low-structured version of the mastership game produced reports that were graded significantly higher than the ones of those playing the high-structured version (and of those not playing the game).

For the generalizability of these findings it will be useful to carry out studies that research the effectiveness of other types of collaboration scripts and implementations in other domains.

ACKNOWLEDGEMENTS

This study was carried out as research activity within the 'Learning Media' program of CELSTEC (Open University of the Netherlands), and within the Lectorate 'Workplace Learning and ICT' (NHL University of Applied Science, The Netherlands). Authors and developers from both institutes worked closely together during development of the game and this study. We express our thanks to both institutes for their funding, and to NHL students for participating.

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