Playing and Reflecting Games:
The Production of Gamified Learning Artefacts in Teacher Education

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At the University, students played and reflected on different games within a digital course conducted by the teaching study program. In one session students chose and played different games. Guided by questions, they discussed and reflected in groups the potential of games for their own future teaching. Their new found experience was critical for the production of a gamified learning artefact in moodle. The self-evaluation showed that the participants were able to utilize their new set of skills and develop, implement and improve a learning artefact over a self-chosen topic. The following paper describes the didactical approach. We share the results of the students perspectives and learning outcomes towards game based dialogue. Students consider gamification and games as useful for different aspects of teaching.

Keywords: gamification, teacher education, Game Based Dialogue, reflection, gamefulness

INTRODUCTION

Didactical Approach and Bigger Picture

We designed a course, in which the students could apply and experience the "4Cs" of the 21st century skills: creativity, collaboration, communication and critical thinking (Fadel et al., 2017). The main learning outcome of the course was that students are enabled to produce a "learning artefact" on their own. We focused on practising and on enhancing students to try new didactical approaches - like playful pedagogy or flipped learning. However, due to the COVID 19 crisis, the whole course had to be held digitally. The course was structured in four phases: knowledge transfer, practice, feedback and improvement and reflection. In the first phase students gained knowledge presented by the authors in three sessions. Every session lasted for about three hours. The topics were knowledge organization (Meder, 2006), introduction to blended learning (Lingo & Handle-Pfeiffer, 2019), constructive alignment (Biggs, 2011), flipped learning (Bergmann & Sams, 2012; Handke, 2013) how to give feedback, media and education (Blossfeld et al, 2018), playful pedagogy (Schmoelz, 2016), gamification (Deterding et al., 2011), E-Moderating (Salmon, 2000), E-Tivities (Salmon, 2002) and how to use moodle (Pfeiffer, 2018). The phase ended in an assignment where the students reflected on their essential learnings.

In the second phase "practice", students had to produce a learning artefact. We defined the target group of the artefact as "interested peers". The participants were given an hour to execute one artefact.

Students were allowed to choose a topic which was relevant for teaching and for their peers. They chose different didactical methods and concepts like "mastery teaching and flipped learning" (Handke, 2015) or "cooperative learning" (Gruber, 2007).

Some learning artefacts referred to digital tools: "arsnova", a student response system (Quibeldey-Cirkel, 2018) or "MS-Teams". Many artefacts included topics like the "austrian education system", "work with parents" or "producing podcasts". Furthermore, the students had to define learning outcomes and present the core ideas of their learning artefact in a short essay.

In the third phase "improvement", feedback was asynchronous provided by the peers through moodle forum and synchronous by the authors in a feedback session. The students improved their learning artefact based on the feedback. At the end of the course, students reflected their learnings in groups in a live session and in moodle guided by questions (Kori et al. 2014).

Focus of this Article

The following article focuses on the three different aspects of the course: (1) The results of the reflection directly after the gaming session and during the phase of knowledge generation based on one minute paper (Angelo & Cross, 1993). (2) Outcomes of the learning artefacts. (3) The overall reflection at the end of the course.

The gaming session introduces terms and definitions of playful pedagogy and game based learning (Prensky, 2001). One emphasis lies on the definition of gamification by Deterding et al. (2011) as "the use of game design elements in non-game contexts." Furthermore, we used the definition provided by McGonigal (2012) to define the term "game": Games have goals, rules, a feedback system and the possibility of free participation. Game design elements like "reward" or "badge", "points", "levels" (Zichermann & Cunningham, 2011), "epic meaning" (McGonigal, 2012), "rankings" (Reeves & Read, 2009), "community collaboration", "progress bar" (Koch & Ott, 2012) were established and discussed. The students reflected on the possibilities for their own further teaching. The term "game based dialogue" (Schmoelz, 2016) was introduced and experienced within a 45 minute gaming session: In the beginning, the students could choose games based on their own ideas collected in a brainstorming session or provided by the authors. The games included "Bad News" (www.getbadnews.de), "Stop the Mob", "Iconoscope" (iconoscope.institutedigitalgames.com), "Beholder" (beholder-game.com) or games in Moodle like "Quizventure" (moodle.org/plugins/mod_quizgame), "millionaire" or "crossword puzzle" (https://moodle.org/plugins/mod_game). The students played these games for about 30 minutes. Afterwards, the students were grouped in seven break-out-rooms (each group with about 5 students) and discussed the following questions:

- Talk about the gaming session:
  - Which game did you play? Describe it!
  - What did you experience while playing the game?
  - Can you name any concrete experiences?
- Reflect:
  - How have you been during gaming? Was it easy/difficult/...?
  - What did you learn while gaming?
  - Do you see any potential in this game for teaching?

At the end of the whole session students focused on two questions in a one minute paper (Angelo & Cross, 1993): (1) "Which important findings did you gain today?" (2) "Are there any topics you would like to know more about?".

The overall reflection at the end of the semester consists of six guiding questions (Kori et al. 2014) and a free reflection:

- What did you experience during the semester?
- What did you learn?
- What was important to you?
- What could be important to others?

- Where would you like to use this knowledge in the future?
- Which possibilities do you think could arise from your newly gained knowledge?

RESEARCH QUESTION AND RESEARCH METHOD

We raise two research questions:
(1) How are future teachers using gamified elements or games in their learning artefacts after experiencing them in a gaming session?
(2) How are future teachers reflecting on gamified elements or games?

In order to answer the first research question, we investigated the implementation of gamified elements or games in the learning artefacts. We analysed the results of the two reflections to address the second research question. Next, we conducted a teaching study course in which the application of knowledge and guided reflection played crucial parts of our didactical approach. Primarily our intention was to conduct a meaningful course for our students. Since the results of both didactical elements – the learning artefact and the reflections – are our main research subjects as well, we used a single case study (Yin, 2013).

We used a mixed methods approach to present the data and classify the reflections (Baur & Blasius, 2014) including qualitative content analysis (Flick et al., 2019) and descriptive statistics (Dawson, 2009). The categories were inductively formed based on the sequence model of qualitative content analysis using the example of inductive category formation (Flick et al., 2019). First, we collected and cleaned the data. Then we checked the data for relevance in relation to the research questions and eliminated obsolete statements. The data was coded, divided into categories and we set up a first draft of code handbooks. After rechecking the data, we improved the handbooks guided by our research questions. We analysed the results, discussed the results and formulated our hypotheses.

We used three different code handbooks. The first and the second code handbook focus on the first reflection (one minute paper), directly after the gaming session. The third code handbook relates on the last reflection of the course. We suspected a profound learning process between the two reflections as a result of a considerable time span in between. Hence we used different questions for reflections and therefore three different code handbooks.

Furthermore we were looking at the learning artefacts and we counted every gamified element or game. Next we formed categories suitable to the game design elements or games (Tab. 1). The term "epic meaning" is central to our findings. We refer to the definition of McGonigal (2012, p. 98): "[...] epic is something that far surpasses the ordinary, especially in size, scale, and intensity. Something epic is of heroic proportions." Additionally, we matched the categories with gamification taxonomy introduced by Toda et al (2019).

The sample consisted of 37 students, studying to become teachers. The participants were in their bachelor degrees but had different subject backgrounds. The answers to the first reflection were handed in anonymously. After handing in their own reflection, the student gained access to the reflections of their colleagues. At the end of the semester the reflections were collected publicly. The students were able to view the reflections of their colleagues prior hand-in.

TABLE 1
LIST AND CATEGORIES OF GAMIFIED ELEMENTS AND GAMES

element in moodle	category	taxonomy by Toda, et al. (2019)
level up (Ranking)	ranking (Reeves & Read, 2009)	Social
level up (Level)	level (Zichermann & Cunningham, 2011)	Performance / measurement
level up (Level system)		
level system in the course		
progress bar in activity lesson	progress (Koch & Ott, 2012)	
checklist		
level up (experience points)	points (Zichermann & Cunningham, 2011)	
moodle overflow (reputation points)		
studentquiz		
h5p memory	games (McGonigal, 2012)	These activies are games, therefore not part of the taxonomy (Deterding, et al. 2011)
h5p word search		
quizventure		
hangman		
snakes and ladders		
sudoku		
millionaire		
crossword puzzle		
crossword puzzle in activity hot pot		
epic meaning	epic meaning (McGonigal, 2012)	Fictional
bonus	bonus (Zichermann & Cunningham, 2011)	Ecological

RESULTS

Here we present the results of the two guided reflections and the use of gamified elements or games in the learning artefacts. Section 3.1 relates to the reflections directly after the session on playful pedagogy and gamification. Furthermore, we take a look on how students apply their new knowledge in building individual learning artefacts (Section 3.2).

Section 3.3 refers to the overall reflection of the whole course. Our results present the extent to which the students remember playful pedagogy and gamification as essential learning outcomes. Moreover, we present how the students evaluate gamification and games for their future teaching.

Guided Reflection After the Session About Gamification and Games

Table 2 shows the individual findings after attending the session about playful pedagogy and gamification. The majority of the students find practical topics to be the most relevant: "Lesson design" and the "possibilities" of gamification and playful pedagogy (47%). Theoretical questions such as why to use methods of playful pedagogy seem to be less important (35%).

TABLE 2
CODE HANDBOOK 1: ESSENTIAL FINDINGS AFTER PARTICIPATING IN THE SESSION ABOUT GAMIFICATION OR GAMES

category	description	examples of student answers	Count; %
lesson design	The code addresses lesson design and questions how to design lessons.	"How to embed games in lessons" "gameful/playful arrangement of lessons"	9; 25%
possibilities	Possible ways of using games in teaching.	"That content could be deepen in a playful/gameful way."	8; 22%
variety	Variety and forms of serious games, games and this topics, Range of this topic.	"That the topic 'games in teaching' is much wider, than I thought."	6; 17%
theory	Background Information about the topic; theoretical approach referring to didactical models.	"Background for using games while teaching"	6; 17%
importance	Importance of the topic.	"Why [...] games should be involved while teaching"	5; 14%
fun	Learning is fun.	"playful learning is fun"	2; 6%
total			*36; 100%*

50% of the students want to expand their knowledge in "lesson design". In comparison, the other categories "serious games" (17%), "gamification" (21%), "game based learning" (8%) and "game based dialogue" (4%) were hardly mentioned (Tab. 3).

TABLE 3
CODE HANDBOOK 2: TOPICS, IN WHICH THE STUDENTS WANT TO EXPAND THEIR KNOWLEDGE

Code Handbook 2: "Are there any topics you would like to know more about?"			
category	description	examples of student answers	Count; %
lesson design	How could we use/design games for teaching?	"With games I can use for teaching" "The application of games in lessons"	12; 50%
Serious Games	References to concrete games, like Ludwig or quizventure.	"on the one hand with Ludwig, because belongs to one of my subjects" "I was fascinated by Quizventure"	4; 17%
Gamification	The concept of gamification or game design elements was mentioned.	"Gamification" "Badges or level" "Gamification. I found it exciting and had a good discussion in the break out rooms about it."	5; 21%
Game Based Learning	The concept of game based learning was mentioned.	"game based learning" "game based learning per se"	2; 8%

Game Based Dialogue	The concept of game based dialogue was mentioned.	"Therefore, it is important, that after gaming, you should talk about and reflect the game."	1; 4%
total			*24; 100%*

Use of Gamified Elements of Games in Learning Artefacts

74% of all students used at least one gamified element or game in their learning artefacts. Figure 1 shows the detailed use of such elements in the learning artefacts. "Games" like crossword puzzle, quizventure, h5p memory, h5p word search, hangman, snakes and ladders (32%, used in 29 learning artefacts) and "progress" (22%, 20 times) were applied very often. In contrast, we only found 2% (2 times) of "epic meaning" and "bonus" (used one time) in the learning artefacts. Other game design elements such as "level" (18%, 16 times), "points" (14%, 13) or "ranking" (11%, 10 times) were used frequently. Overall, every gamified learning artefact included at least one game or game design element. The maximum use contained 9 elements in one artefact and the average use was 3,5.

FIGURE 1
DETAILED USE OF GAMIFIED ELEMENTS OR GAMES IN THE LEARNING ARTEFACTS (N=91)
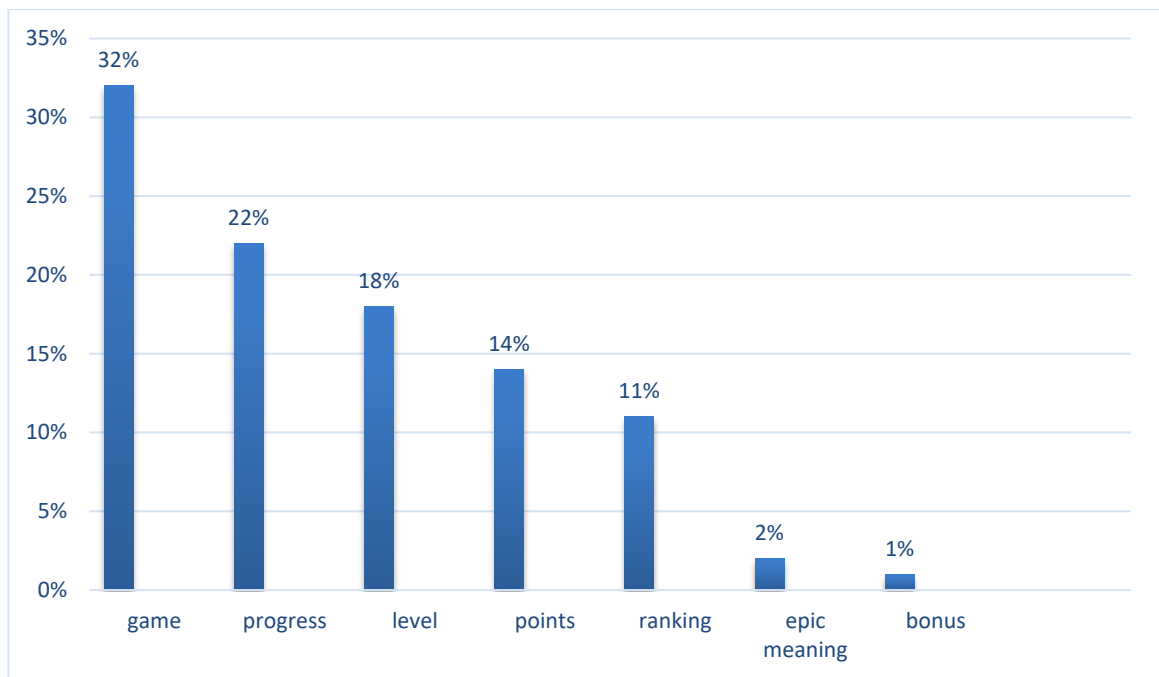

Figure 2 shows an example of an idea of linking a dungeon crawler with a moodle course. The student structured the artefact in different stages, in which the learners get information and solve tasks (e.g. tests or games, snakes and ladders, ...). The student tried to create a story and embed the content which refers to "epic meaning".

FIGURE 2
DESIGN OF CLASSROOM MANAGEMENT DUNGEON

Figure 3 shows the use of a pedagogical agent (Johnson, 2000). The student tried to create a tutor who guides the student throughout the course. The tutor addresses the learner directly. In this example the tutor says: "You have two choices. Do you rather like to "work freely" or "get strict briefing". Select one of these two choices." Hence, the learning artefacts is structured in levels. The figure below shows students photoshopping his smiling face on a stickman. In the figure his face is anonymized with a blue smiley.

FIGURE 3
EXAMPLE OF PEDAGOGICAL AGENT

Figure 4 shows how the moodle activity "level up" (moodle.org/plugins/block_xp). It was used by a student in his learning artefact. He personalized the level system by three levels. Level 1: student, level 2: teacher, level 3: master. The levels refer to mastery teaching in context of flipped classroom. We can see a ranking at the top right of the picture and the description of the levels at the bottom right. In picture one and two we can see a progress bar. In the default settings of "level up" a star containing the level number would usually be displayed and there would be no description.

FIGURE 4
EXAMPLE OF USE OF "LEVEL UP" IN THE WILD

Usage of „level up" at top level in moodle

Individualized level system of „level up"

Overall Reflection of the Course

After completing the course 73% of the students mentioned gamification or games as an essential learning outcome.

In table 4 we present the students evaluations of their learning outcomes in respect to their own future teaching. The largest category is "potential for further teaching" (47%). The students want to use elements of gamification or games for their further teaching (20% of entries). Approximately 31% of the comments indicate a simple recollection of the topic. Only 2% of all mentions show a "negative attitude" towards gamification or games.

TABLE 4
CODE HANDBOOK 3: OVERALL REFLECTION ABOUT GAMIFICATION OR GAMES

category	description	examples of student answers	Count; %
potential for further teaching	Students see potential in gamification or games.	"With gamification elements you have the possibility to show complex content playfully and inspire learners" "I think especially for younger kids playful learning is a important and good way to teach knowledge"	21; 47%
learning outcomes	Students learn about gamification or games.	"the principles of gamification/game based learning sticked positively in my mind." "We learned a lot about Gamification, game design or narratives"	14; 31%
application in further teaching	Students plan to apply gamification or games in further teaching.	"Before the course I did know serious games, in the future I would like to integrate them in my teaching."	9; 20%

negative attitude	Students have a negative attitude towards gamification or games.	"Personally I am not sold on digital games for teaching, but if I would need them in future, I know how and where to find information about it."	1; 2%
total			*45; 100%*

DISCUSSION

We show that future teachers use game design elements available in moodle (e.g. quizventure, ...). In contrast, games or elements that are not integrated in the learning platform are less popular (for example H5P, which is not integrated directly in moodle). The most common applications are either used for assessments (e.g. "quizventure") or for giving orientation and feedback on the learning process (e.g. "progress bar").

First, we discuss "quizventure" and the multifunctional level system "level up". "Quizventure" can be seen as an assessment tool that is fun, action and retro. These characteristics of "quizventure" may explain its popularity among the students. Furthermore, the evaluation and assessment of learning success should be a core process for teachers (Biggs, 2011). Moreover, evaluation in a gamified way is more fun, than simply using traditional tools like "online tests".

These games use closed-ended questions and students are used to those kind of questions. They witness this type of evaluation in their daily life (e.g. Multiple Choice Tests) (Universität Zürich, 2019). We expect students to be able to construct such questions, since it is part of their profession and qualification. Finally, close-ended questions can be used in different contexts (eg. Moodle activity test, quizventure or offline test).

Looking at the game design element "level", the moodle activity "level up" was used frequently. "Level up" comes with a wide range of functions: A progress bar, experience points, a ranking and obviously levels. "Level up" is well integrated in moodle.

Along these frequently used tools, the scarce usage of epic meaning is intriguing. We found two different examples. A dungeon crawler that was integrated in moodle (Fig. 3) and a pedagogical agent, who guides learners through a level system (Fig. 4). Why did only two students use the mechanics of epic meaning?

We expect the high workload (coming up with a narrative, think about how to tell it) and the need for creativity as reasons for its unpopularity. Moreover, "epic meaning" is not integrated in moodle.

Matching the used game design elements (Fig. 1) with the taxonomy by Toda et al. (2019) we see that 54% of the used elements address performance and as a result the measurement of learning. Here, these questions come to mind: Why students tend to measure learning behaviour? Are they aware of their doing? We think that besides the measurement of these elements, they provide orientation and feedback as well. From an interaction point of view such activities frame the course design and therefore the learning process. On the other side learners get automated feedback, which could be a strong motivator.

Taking a closer look at the results of the reflection directly after the gaming session, we made one observation: Students find practical topics to be the most relevant. E.g. "how to embed games in lessons" (Tab. 2). 25% of the entries state that lesson design is a key finding of the whole gaming session. Another 22% suggest the possibilities of gamification and playful pedagogy to be important for the individual learning success. In contrast, the theoretical topics such as background information (17%), or the question as to why that learning approach might be important are hardly noted (14%). We see the statements on "variety of gamification" as somewhere in between: There are some entries that refer to practical approaches but there are some theoretical notes as well. It seems that the students are looking for didactical recipes to enhance their teaching, rather than focusing on a theory-practice transfer. Some examples include: "How can I adapt digital games, to make them informative?" or "How and when do I apply digital games in my tuitions?".

Looking at Table 3 we reached the same conclusion: The practical topics are of most importance. Up to 50% consider the "lesson design" as a subject relevant for their future teaching. Concrete serious games made up 17% of the entries. On the other hand, theoretical topics such as a rather vague interest in gamification, game based learning or game based dialogue make up 33%. These results support our original hypothesis that future teachers are mostly interested in practical subjects. Some examples include: "Possibilities of usage in my particular subjects"; "the usage of games in my teaching"; "finding even more games, and thinking about how they can enrich my lessons".

Even though gamification and games only made up approximately a quarter of the knowledge transfer, 73% of the population mentioned it to be an essential learning outcome at the end of the course. We find the topic to have been considered interesting and for some meaningful for the individual learning process. We analyse the results of the overall reflection to dig deeper into this observation (Tab. 3). While 31% of the entries relate to basic concepts of gamification, 47% refer to a (more or less high) potential of the teaching approach. 20% of the entries considered the topic not only to be relevant for the individual learning process but also that gamification or games will be part of future teaching sequences. We point out that the students see playful pedagogy as a wide field offering many possibilities for their (future) teaching. Interestingly, 67% of the mentions see a strong positive effect of gamification or games on the learning success. However, only 20% consider making use of this learning approach in future. This finding does not correspond with the application of gamified elements in the learning artefact in which 74% of the population made use of such elements.

These observations raise questions: If students see such a high potential in gamification, why is it only a fraction that want to make use of the concept for their future teaching? And - if that is the case - why did almost three quarter of the population use gamified elements in their own learning artefact?

One reason might be that the students don't see gamification as reasonable concept in a traditional, offline teaching context. Two entries expatiate on that: "[...] should there be another pandemic that paralyzes our school system the knowledge about constructing such digital elements is a good solution [...]". Or "[...] should I ever be in the situation where I have to teach online, I will surely make use of the things I learned [...]".

Another option is that implementing such elements is time-consuming. We argue that the significant use of gamified elements in the learning artefacts is based on the context of this field study: The students conducted a course, in which the construction of an excellent and elaborated learning artefact is part of their final assessment. Furthermore, there were several feedbackloops. In these loops students and teachers pointed out that the integration of gamified elements could be useful in some aspect. In that light, the discrepancy of used gamified elements in the learning artefact and the application of such elements in further teaching is comprehensible.

CONCLUSIONS AND REFLECTION OF ESSENTIAL LEARNINGS

The reflections of the students show that they consider gamification and games as useful for different aspects of teaching (research question 2). The benefits of using this approach are increased learning success and motivation (Kapp, 2012; Prensky, 2001). Even though we found a positive attitude towards gamification, the application of such elements might be restricted to experienced and motivated teachers (research question 1).

Our findings show that future teachers are primarily interested in practical topics. The teachers want to learn *how* to make use of games or gamified elements rather then *why* to use them. The underlying theories seem to be less important.

Further Steps in Course Design

We will increase the use of cooperative and collaborative teaching methods in future. Hence, grouping students has multiple benefits from a didactical point of view (Gruber, 2007). Based on our findings we expect that this setting could lead to a more creative environment and also to less effort on an individual basis. As a result, the lack of epic meaning may be overcome. Furthermore the importance of the theory-

practice transfer should be strengthened. We aim to emphasise the theory-practice transfer even more in the future. Thus, we will develop and apply different tasks to enable the students to transfer theoretical subjects into practice. Based on a didactic model the different technical terms like "gamification", "game based dialogue", etc. will be discussed theoretically.

We will remind the students to focus on learning outcomes to guide the students to use appropriate games in their teaching. We found the definition from Deterding et al. (2011) of gamification to be impractical within the educational field. Especially the boundary to game is elusive for students. Additionally we will introduce the definition from Kapp (2012). Kapp not only explains the term, he also states different goals such as "[...] to engage people, motivate action, promote learning, and solve problems. (Kapp, 2012, p. 54)". These goals are especially relevant in the context of learning. We think, that this definition will make it lot easier for teachers to implement gamified elements or games in their teaching and we hope that this will lead to a greater understanding of the topic.

Limitations

We recognise that our data is limited in terms of the game based dialogue session. The students should have collected and handed in their personal highlights. This would increase our understanding of which games were played and which topics were discussed. We consider this field study as a pilot study: It would be interesting to deepen the discussion. In the future, we would like to investigate the following questions: (1) Why did students prefer certain specific game design elements or games? (2) Especially, why did they use game design elements which addresses performance/measurement? (3) Why did the students avoid game design elements like "epic meaning" or elements which address a fictional nature?

Finally we would like to summarise our findings using a quote by one of our students:

> "[…] Don't teach the way you know it from your own schooldays - school has to evolve unconditionally by us (new teachers)."

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