A Theory-Driven Design Science Research Approach Towards Gamified Videos in Digital Learning

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Abstract. Digitalization has opened new opportunities but also brought new challenges such as lower engagement of students in online training. Especially learning videos need to be changed in their design and structure to make them more engaging for users. So far, overarching design principles are missing that support the development of gamified learning videos. In our research-in-progress paper, we present an overarching approach on how to develop meaningful gamified learning videos. With our design science research approach, we plan to derive design principles and design features from our state-of-the-art design requirements. Additionally, we will conduct a field experiment to put our theoretical contributions to test and gather practical insights. Our research contributes to theory by clarifying how and why gamified videos can support better learning. In the long run, practical contributions can be given to developers about how to construct gamified learning videos.

Keywords: Gamified videos · Design · Learning · Engagement · Motivation

1 Introduction

Adapting learning techniques for the digital age is a challenge for individuals and organizations. This challenge may emerge due to technological changes, new policies or other disruptive factors. For students and universities this poses significant problems that need to be overcome. Technology-mediated learning (TML) offers tools that potentially can solve those issues [1, 2]. TML combines the advantages of synchronous (i.e., face-to-face) and asynchronous (i.e., technology-based) learning approaches [3]. Videos are one technology-based component of TML for educational purposes. Designing learning videos is a challenge on its own since bad design can demotivate students. Nowadays, videos are a well-established instrument in education [4] and have proven to be an effective tool [5]. In fact, studies have shown that many students prefer videos as learning material [6] and 47% of students use platforms like YouTube for their learning activities [7]. Because of the high effectiveness and acceptance of learning videos, continuous growth in learning videos can be observed [8]. Especially in the current times of the global COVID-19 crisis, online learning applications including the use of video content

may become even more popular and offer the means to overcome the disruption in the educational systems [9].

Regardless, videos in learning most often fail to engage and motivate students if they are designed badly [10]. A prime example of this are long-winded and pre-recorded classroom lectures that effectively fail to engage and motivate students [10]. Therefore, it is important to address this potential issue by design to support the engagement and motivation of students, as both are critical factors for the learning success and well-being of students [11, 12]. Engaging and motivating students to pay more attention to videos they are learning with can happen by referring to gamification [13]. Gamification has been implemented successfully in many learning contexts before (i.e., [14, 15]). One successful example of gamified learning includes distance learning (e.g., e-learning), where gamification improves student interaction and learning experience [16, 17]. While both gamification and videos have been successfully used in e-learning applications on their own, details about applying gamification directly to learning videos remains yet to be explored as literature on this topic is virtually nonexistent. In order to create a first gamified video prototype and study its effects on student engagement, motivation and learning success, some guidance is recommended. Therefore, we use a DSR approach and start with formulating requirements on which we will base our DSR artifact [18]. Accordingly, gamified videos offer a twofold research opportunity regarding the design requirements as well as the potential effects on digitalized learning. Consequently, with this research-in-progress paper we demonstrate an approach of how we will develop and evaluate gamified learning videos and formulate the following research questions (RQ):

RQ1: What are design requirements for designing gamified videos in learning?
RQ2: What are the challenges of using gamification concepts for this type of media?

To answer the research questions, we propose a research approach based on Design Science Research (DSR) [19, 20]. We start by conducting a systematic literature analysis. Next, we derive design requirements from the literature, which refer to theories found in the literature. To support theory, we plan to conduct focus groups and workshops with stakeholders (e.g., students and tutors) at a university to gain practical insights. Using both theoretical knowledge and practical insights, we then plan to develop a first gamified video prototype that we plan to deploy in a real-world setting (i.e., university course with approximately 300 bachelor students). The main contribution of this research-in-progress paper is to provide an overview about our overall research approach for the development, analysis and evaluation of gamified learning videos. Overall, we hope that both theoretical researchers and practitioners will be able to draw from our planned contribution as we will demonstrate requirements about how to design gamified learning videos.

2   Theoretical Background

2.1   Gamified Learning

Learning with technology enables learning from anywhere and at any time, thus providing higher autonomy [21]. The increasing number of interdisciplinary programs leads

to different kinds of learning situations that can be handled more effectively by using gamification [21]. Hence, gamification is a possible approach to motivate and engage users to use systems more regularly and conduct more in-depth learning by supporting their motivation. Hence, gamified learning and the use of gamified videos in learning has two purposes. The first is to encourage desired learning behavior. The second is to engage the users in learning using learning materials such as tutorials, digital documents or learning videos. Therefore, engagement has been proven to be positively correlated with the outcomes of user success, such as user satisfaction and academic achievements [22, 23]. Accordingly, gamification increases the motivation of users by providing different game design elements [24], by making an activity or task more fun and engaging and by encouraging exchange between users.

2.2 Fundamentals for Gamified Learning Videos

In general, gamification is an umbrella term that can be considered as the application of game design elements to a non-game context in order to motivate and engage users [25, 26]. However, the term can also be defined as a process of enhancing services, like learning videos, with motivational affordances to invoke gameful experiences and support desired behavioral outcomes [26]. Gamification essentially contains three components, namely motivational affordances, psychological outcomes and behavioral outcomes [26]. To combine the definitions stated above and to align them to the use of learning videos, we define gamification as the use of game design elements in learning contexts with the intention to increase a student's motivation and engagement.

All along one component is important when designing a gamified application and creating gamified videos for learning – game design elements. Generally, game design elements can be divided into certain groups by referring to the MDA Framework [27]. This framework suggests that game elements can be categorized as mechanics, dynamics or aesthetics, whereas game mechanics are those that can be worked with and designed for a gamified video [27]. Mechanics are the functioning components of a game that grant the designer ultimate control over the levers of the game so that the designer is able to guide the actions of the user [28]. Dynamics, on the other hand, are described as the player's interactions with mechanics. They determine what each player is doing in response to the mechanics of the system. Finally, aesthetics describes the emotional responses evoked in the individual while interacting with the game system.

To implement gamification, game design elements are used. In our study we refer to the taxonomy of game design elements introduced by Schöbel et al. [24]. The taxonomy classifies game design elements (attributes) like points, badges and levels according to the general categories representing the mechanic behind each game design element. For example, the mechanic *progress* refers to the game design elements *level* and *progress bar*, whereas *points* and *badges* represent *rewards*. Schöbel et al. [24] present the *feedback* game design element, which refers to *guidance* including visual cues. However, we also include non-visual representations in our study, as visual implementations like avatars may distract students from already visual media (i.e., videos). Instead, we will focus on easy to implement elements like, for example, points, badges, levels or textual feedback, depending on the findings of our literature review. Game design elements like time manipulation can be a difficult game mechanic to integrate. Because our intended

content is of educational nature, the content itself can already introduce a significant cognitive load on the users [29]. Thus, introducing time manipulation can cause cognitive overload and create a negative experience.

Because gamified videos are a novel concept, there is no literature that we can directly derive integrations or applications of game mechanics from. Therefore, we refer to common uses of game mechanics that are not necessarily academic. For example, the learning platform Duolingo employs user-set goals to motivate students to follow their learning schedule. Another example is the popular streaming platform Twitch.tv, where viewers gain points for view time.

3   Methodology and Status Quo

This research-in-progress paper presents a DSR [19, 20] approach towards gamified videos. We base our research design on a well-regarded framework for DSR projects in the information systems research domain [30, 31], as illustrated in Fig. 1. Part of our research is the review of literature. Therefore, we adopt the literature review methods as suggested by Cooper [32] as well as Webster and Watson [33].
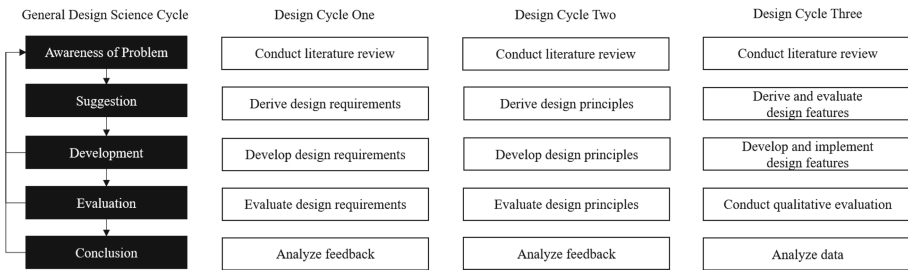
General Design Science Cycle	Design Cycle One	Design Cycle Two	Design Cycle Three
Awareness of Problem	Conduct literature review	Conduct literature review	Conduct literature review
Suggestion	Derive design requirements	Derive design principles	Derive and evaluate design features
Development	Develop design requirements	Develop design principles	Develop and implement design features
Evaluation	Evaluate design requirements	Evaluate design principles	Conduct qualitative evaluation
Conclusion	Analyze feedback	Analyze feedback	Analyze data

Fig. 1. DSR agenda towards gamified learning videos

Because of the nature of our approach, we focus on the applied theories or practices and applications (i.e., implementations) of gamified video material or environments, as the study closely relates gamification and video content. The goal of our review is to integrate the findings into our design requirements, which we then translate into design principles and eventually a feature that we will implement in our artifact. Since our gamified video approach is novel, we chose an exhaustive coverage for our literature review to gather as much input material as possible and provide an overview that is as comprehensive as possible. Lastly, the organization of our literature review focuses on the concepts and methods used in the considered studies. As for the search process, we search ACM, AISeL, IEEEXplore, JSTOR, SSRN, ScienceDirect and SpringerLink, where we consider only peer-reviewed articles. For the database search we used a combination of the following keywords: gamification, learning videos, education and videos. We used wildcards whenever possible and adapted our search to the properties of each database. We then conduct a forward and backward search as introduced by Webster and Watson [33] with no restrictions, which allows us to expand our horizon and include

non-scientific sources. Overall, we identified 1569 potentially relevant papers during the database search. After analyzing abstract and title, we kept 35 papers which we then examined in detail. The preliminary results of the literature analysis suggest a research gap for gamified learning videos. We can observe that literature about learning videos and gamification in learning focuses on three major theories: Self-Determination Theory [34, 35], the MDA framework [27] and the ARCS model [36, 37]. Moreover, all studies have in common that they try to support either the motivation or the engagement of students, some address both factors. As for the gamification elements, we find an array of elements being used, with points (e.g., [38–40]) and feedback (e.g., [15, 41, 42]) being used the most. However, we did not find a single study that included time constraint as a game element. Consequently, we will base our design requirements on these three major theories and focus on feedback and points as game design elements. Interestingly, the latter is already being used in real-world applications such as Twitch.tv, which gives points to users based on the amount of content consumed. Nevertheless, we have to acknowledge that due to the nature of the media (i.e., video content) some gamification elements may be hard or impossible to apply. We therefore will conduct a workshop with stakeholders including tutors and students at a university during future DSR cycles to find viable design elements that can be translated to a practical artifact.

4 Next Steps and Expected Contributions

For the next DSR cycle we plan to extend our literature review into neighboring disciplines and also include a more comprehensive media survey. Thereto we will extend our literature scope to interactive learning videos and studies that focus on gamifying the environment. Additionally, we plan to conduct focus groups and workshops with relevant stakeholders using design thinking [43, 44] methods to further support our theory-derived design requirements. In the second design cycle we then translate our developed design requirements into design principles that we will evaluate with relevant stakeholders. The third design cycle then aims to implement our developed design principles into a first prototype artifact of a gamified learning video that we will integrate in an online learning course at a university. The course will be targeted at a large audience of bachelor students; participation will be voluntary to prevent utilitarian motives behind using our gamified learning videos from the students' perspective. Results will be evaluated with quantitative methods to measure the effects of gamified learning videos on the academic success via a short examination, while motivation and engagement as well as the well-being of students are tested using a questionnaire. The field experiment will be designed as an A/B test. Overall, our research contributes to the design knowledge of digital learning by determining how and why gamified learning videos can support better learning outcomes. In this regard, we also highlight potential difficulties that are rooted in the nature of the media that we will address in-depth in future research. We hope researchers and practitioners will draw on our contributions to improve learning in the digital age by designing and developing gamified learning videos. Nevertheless, we also acknowledge the challenges we face due to the nature of video as media and the limitations rooted in our context (university online course) as well as our chosen methods and literature review.

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