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Jamming the assessment: The viability of a *Twine* game jam as a learning evaluation tool in higher education

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ABSTRACT

While game jams, rapid game co-creation events, have seen increased interest in learning contexts, their potential is still largely untapped. In this paper, we examine game jams as a form of *playful assessment*. We evaluate the potential of game jams to serve as a tool for assessing learning processes and goals of higher education students.

The study is built around two instances of a university course focusing on the analysis of storytelling in digital media, taught during the autumn terms of 2018 and 2019 at the University of Helsinki. Both instances included a *Twine* game jam with the idea of giving the students a hands-on insight into highly abstract topics. In our qualitative study, we examined game jam experiences of the students through their written reports. Following research questions were formulated: Is game jamming with *Twine* a viable tool for assessing student learning on a university course? What limitations and requirements are there in the use of game jamming in assessment?

Through thematic analysis, we identified categories related to student learning and their experience of the game jam in the data. Categories were examined against the learning goals to discern how students were applying knowledge and concepts obtained during the courses.

Our results suggest that the game jam format encourages reflection of the course content as well as its application. Game jams potentially complement existing, more conventional assessment methods as they strongly encourage the jammers to engage with and apply knowledge they have acquired.

Introduction

Game jams are accelerated game creation events, often with constraints on the time available or the technology used. While they have seen increased interest in both leisure and learning contexts (e.g. Fowler et al., 2016; Meriläinen et al., 2020), their potential is still largely untapped. In this paper, we examine game jams and

learning from a novel point of view: as well as assessing learning in game jams, we examine game jams as a form of assessment. By means of examining game jam experiences of higher education students through their written reports, we evaluate the potential of game jams to serve as a learning evaluation tool in higher education.

Earlier research (see Vos, 2015) suggests that when combined with assessment elements, games and simulations can enable teachers to assess more complex skills, such as analysis, problem solving, and critical thinking, by introducing an element of practical application. Furthermore, in pedagogical settings, games have been found to be complex, multimodal systems that, as such, help students to see ideas in new ways (e.g. Shultz Colby, 2017, 69). This potentially allows teachers to gain a more comprehensive understanding of what students know. In these instances, assessment can reveal not only what a student knows but also whether they are able to apply their knowledge in a meaningful way. Drawing from the constructionist learning approach (see Kafai & Burke, 2015), this study explores how making games, rather than playing them (cf. Vos, 2015), can be used as a part of student assessment in higher education.

As intensive, creative events often require both novel problem-solving and collaboration with others, game jams can support and promote learning in both formal and informal settings (for a review, see Meriläinen et al., 2020). In a game education context, game jams have been seen to bridge the gap between formal studies and working in the game industry (Mikami et al., 2016; Pirker, Kultima & Gütl, 2016) by allowing students to fully participate in a game creation and development process, although a very much condensed one. This aspect of applied knowledge as a learning outcome is particularly relevant to the study at hand.

Applying the knowledge in the form of digital game design has potential for empowering students through, for example, experiences of increased self-efficacy, and dispelling pre-existing notions of lacking technological skills (Kafai & Burke, 2015; Meriläinen, 2019; Meriläinen & Aurava, 2018; Yang & Chang, 2013), which can further advance the learning process. In summary, using game jams as an assessment method potentially offers twofold benefits: firstly, the game jam session itself is a learning experience for students. Secondly, it can be used to reflect on learning and thus to assess learning by the course teacher (e.g. how well students have internalized the course contents).

Methods

In this qualitative exploratory study, we examine the use of game jamming as a pragmatic tool for assessing learning processes and promoting the learning goals of the students in higher education. Our study is built around two instances of a university course titled "Analyzing Storytelling in Digital Media", taught by Author 1 during the autumn terms of 2018 and 2019 at the University of Helsinki. Both instances were optional courses under the category of "special topic" in the Master studies' program in English philology. Most of the 37 students attending them were English majors either in literature or in teacher training, and no student had previous experience in game studies or designing games of their own.

The aim of both courses was to provide students with a grasp of tools and methods to study storytelling and narratives in digital media and, as a learning outcome, to enable students to apply these tools and methods to analyze both the processes of creating and using digital media. This is also the reason why digital games were an integral part of both instances of the course: they fit very well for examining digital media from the double perspective of both the audience (player) and the author (designer). As Cross (1982) suggests, design is a process of finding solutions to ill-defined problems. This means that there is never enough information to fully analyze design problems and a satisfactory solution must be found by trying out different solutions in contrast to well-defined problems that have specific goals and clear solutions. As such, it is hard to define what the end result of the design process will be, but coherent results can be achieved by boldly engaging with it. This approach offers a new perspective to knowledge-construction and has potential to prompt students to internalize the knowledge as they apply it and through this supports learning. Furthermore, the jam itself or the resulting game were not the main focus of the assessment, but the process as well as reflection in the written report of the jam.

The last item on both instances of the course was a game jam using *Twine*, an open-source game creation application for building branching narrative games, created by Chris Klimas in 2009 (see Friedhoff, 2013). *Twine* was chosen for the course as it requires minimal programming skills from its user, but still is quite flexible and versatile as an environment for creating stories with, for instance, variables and conditional logic. Moreover, as *Twine* is story-based and text-driven by nature, making games with it does not rely too much on existing knowledge of specific types of games – rather, it is positioned between traditional literacy practices (e.g. writing stories) and digital literacy practices (e.g. making games) (see Tran, 2016). These characteristics meant that the teacher felt it to be quite suitable as a game development tool for the course on digital storytelling with students specialized mainly in print literature. Finally, *Twine* publishes directly to HTML, so it was easy for the students to post their completed games on the Moodle platform used during the courses.

In the jam, the students were prompted to make good use of the ideas and concepts – such as database, procedurality, and reciprocity – discussed during the course. Here, the idea was to make use of games' unique potential for encouraging the students to apply and enact abstract concepts through play instead of simply memorizing them (see Shultz Colby, 2017). On both courses, the game jam was organized as an ultimate part of the group exercises, and the students worked either in four- or five-person groups. Previous group exercises included reading group sessions on research articles, addressing key topics of the course from both theoretical and more pragmatic perspectives. Before the game jam, the main features of *Twine* were well in advance introduced by the teacher, and the students received two-page written instructions. They were instructed, for instance, to make preliminary plans for the games (e.g. organizing a meeting to discuss the plans, or sharing ideas online) and assign each group member a role for the jam (programmer, story designer, recorder). The actual jam with face-to-face participation lasted approximately two hours.

After participating in the game jam as a part of their groups, on both instances of the course the students were instructed to write an entry into their course journal – which they kept throughout the course – and reflect on their personal experiences of the jam with the help of several questions, such as "What kind of insight did designing and developing an interactive story give to the topics of authoring and using digital media?" and "What was the hardest part of designing such a story, and what was the most rewarding?" Moreover, both courses in 2018 and 2019 ended with a debrief session, where all groups presented the results of their game jam session and were able to give feedback to others.

The data for our study comprises of the course journal entries written by the students after the game jam sessions (34 entries of the jam participants; 3 entries of independent experiments from students who could not participate – they tried out making a small game on their own). All entries were written in English. Entries are referred to as R1-a–R21-a from the first instance of the course taught in 2018, and R1-b–R16-b from the course taught in 2019. In total, the data consists of 19,344 words.

The journal entries were looked at in relation to the learning goals, which were outlined on the both instances of the course as follows: the students should 1) have a good grasp of the characteristics and affordances of digital media, especially in comparison with the so-called print or legacy media, 2) be able to apply relevant theories to the analysis of storytelling in various forms of digital media (e.g., games, social media), and 3) be able to write reflectively on their own interpretations of the works and applications of the methodology.

Research questions were formulated as follows:

> **Q1.** Is game jamming with *Twine* a viable tool for assessing student learning on a university course?
>
> **Q2.** What limitations and requirements are there in the use of game jamming in assessment?

We addressed the questions by conducting a thematic analysis as described by Braun and Clarke (2006). Thematic analysis is a qualitative analysis method for identifying themes in a data set. It is useful for its flexibility, as it is compatible with a range of different theoretical and epistemological approaches but is not limited to any single one (ibid.). This flexibility does not mean, however, that thematic analysis would be conducted in a theoretical or epistemological vacuum, as it follows the established structure well described by Castleberry and Nolen (2018). As a method, it is also closely related to qualitative content analysis, and these two terms are sometimes used interchangeably (Braun et al., 2019).

The data were examined by all three authors, going over them several times in an iterative coding process. Based on author interpretation, codes (e.g. technical challenges or reflection on course content) were assigned to relevant passages in the text, for a total of 30 individual codes. These were then grouped to construct sub-themes (e.g. Group dynamics), some of which were in turn grouped to build the broader themes discussed in the results section. In addition to this, Author 1's observations of the students, their group work and overall performance both in the course and in the jam were made good use in the analysis of the data.

We identified themes mainly on a semantic level, focusing on what the students explicitly reported and sought to interpret it, rather than seeking to discern latent themes in the journal entries. Our method falls into the school of reflexive thematic coding where the coding process is an organic one and themes result as an output of the analysis (Braun et al., 2019, 848). An inductive approach with a focus on description and interpretation was seen as useful when conducting exploratory research on a little-known topic where a coding framework is difficult to formulate before the analysis process.

The use of thematic analysis allowed us to identify themes related to student learning and their experiences of the game jam in the data. These themes were then examined against the learning goals of the two instances of the course to discern how students were applying knowledge and concepts obtained during the course when designing a narrative game of their own. In this article, we focus primarily on the assessment dimension, while the game jam as a learning experience will be discussed in more detail in a forthcoming paper.

Results

In this section, we discuss our two research questions and answer them drawing from our interpretation of the data. We identified four broad themes relevant to the assessment of learning and course goals: *Learning*, *Diverging experiences* (with the sub-themes of *Group dynamics* and *Preparation*), *Format constraints*, and *Empowerment*. While these themes are distinct, there is some overlap in them, and they intertwine in many ways.

Our data suggest that the short game jam format encouraged reflection of the course content as well as its application. However, the results were not uniform, with notable individual variation. The results are discussed theme by theme, with example quotes used to illustrate the discussion. The quotes have been taken directly from the course journals. Minor grammar (e.g. missing prepositions) and typing errors have been corrected, but quotes are otherwise unedited.

Learning

The theme of *Learning* consisted of responses that explicitly included reflection and application of the content of the course, as well as mentions of learning taking place during the game jam itself. Responses included, for example, comparisons between digital games and legacy media, the application of theories discussed during the course and descriptions of new perspectives stemming from the jam.

Learning and the ways in which it is demonstrated are obviously crucial to the assessment dimension of the game jam. The jam works in a dual role: the jam and the following written report not only allow students to apply what they have learned, discuss it, and thus display their academic skills, but also further their learning. Thus, the game jam serves as not only an assessment tool or a pedagogical one, but both, as these quotes illustrate:

> Now that I think of it, this jam tied the whole course together as it took us back to the concepts we have discussed more or less throughout the autumn, such as *designer*, *meaningfully responsive* and *reciprocity*. Having to make use of these in a more concrete way made me see how immersive storytelling and different narratives can be on digital platforms. (**R9-b**)
>
> Procedurality is easy to implement, while reciprocity is difficult. Giving players choices that allow them to find their own path within a game is simple but allowing the game to change based on their choices is very difficult, it requires coding that is as clever as the players. (**R13-a**)
>
> The player's experience is at the forefront: compared to watching movies as a passive experience, for instance, digital media demands a much greater level of engagement. However, in order for any activity to be triggered, an adequate environment that will stimulate interaction, or rather, participation, has to be established first. (**R16-b**)

These responses reflect what is known as *designerly ways of knowing* (Cross, 1982; 2001): in other words, there are forms of knowledge that can be achieved through the design process that differs from the more acknowledged scientific and scholarly ways of knowing. Each of the three ways of knowing has differing methods, values, and focuses. Scientific study focuses on the phenomena of the natural world while scholarly study – in other words, humanities – is interested in human experiences. Design, in turn, focuses on the man-made world, and can also be sometimes considered as technical knowledge. While a few students on both instances of the course had experience in writing fiction in the form of short stories, for all jam participants this was their first actual experience of game creation. In other words, the game jam successfully served to bridge the gap from theoretical concepts to practice. Furthermore, designing a game in digital format supported the learning outcome of the course, which was to enable students to apply tools and methods to study storytelling and narratives in digital media to analyze both the processes of creating and using digital media. This is aptly illustrated by the first quote above, which captures the pedagogical intention of the jam.

Although there is a threshold in learning a new digital tool, creating a non-digital game can involve much more tedious work as well as require more existing game design understanding, as one must create the game mechanics from a scratch and thus also test them more comprehensively. Furthermore, as the affordances and limitations of *Twine* software guide the design work, it benefits the design process. In the contemporary world, design skills are important for everyone and learning to think like a designer can help students in solving complex problems in their studies, in the professional world, and life in general (Razzouk and Shute, 2012).

The depth of the reflection on the methodology and the individual learning processes varied from student to student, as some of the students mostly focused on describing their work and the game they designed. However, the variations were in line with the quality of the students' course journals in general.

Diverging experiences

In our data, the most considerable variation between the students concerned the game jam experience. The sub-themes of *Group dynamics* and *Preparation* suggest the two main reasons for these differences. Although the game jam was a positive, interesting experience for most participants, issues such as lack of preparation or poor group dynamics meant that some participants enjoyed the event less than others, or left them with a feeling that they could not contribute as much as they would have wanted. These experiences suggest that even when technological barriers to entry are lowered, personal and interpersonal dynamics play a considerable part in the jam experience (see Meriläinen & Aurava, 2018). The sub-themes underline the importance of both social facilitation (see Kultima, Alha & Nummenmaa, 2016) and group preparation for a successful and enjoyable game jam experience. Consider these two rather negative experiences:

> Frankly, I dislike group work, and this is why: every time there is someone who does not do their job. It often happens that some person gets saddled with all the work. In this case it was worse. The people who did not do their share of the work sabotaged everyone else's work. (**R2-b**)

> The main problem was probably the lack of time and preparation. Well, in a sense the lack of preparation came from our part, we could have done as much or as little as we desire, but I believe the incentive (and our group's co-operation) off-class was not there. (**R10-a**)

At the same time, compared with the reading group sessions, game jam interestingly produced more detailed reflection on the group dynamics as one of the factors affecting the students' learning during the course. These two experiences illustrate some aspects of this:

> As a group work, I feel like this jam session taught me a new kind of group working skills. Developing a game together in a small amount of time requires more flexibility and the ability to cooperate with ideas that you may not like so much, because you really cannot get stuck in a super small detail (**R1-a**).

> Granted, there are student(s) in the group who I know have never in their lives played a story-driven game and I want to clarify that there was not inherently anything wrong with the game jam design as it might have opened new horizons for those less versed in gaming. As for me, I simply could not challenge myself and learn something new as a mere observer/programmer-assistant. (**R12-b**)

While diverging experiences are inevitable in any group work situation, negative experiences such as the ones above pose a significant challenge to assessment (e.g. Vos, 2015). While it is not the jam itself or the resulting game that is being assessed but rather the process and reflection in the written report of the jam, it is apparent that in some groups work was much more successful than in others.

Of course, learning and practicing the fundamental skills in group work, such as organization, planning, communication and conflict resolution, is important for any higher education course involving group work exercises, and our results suggest that an assessment method such as a *Twine* game jam supports this. It is

important for the course teacher to consider the role of learning such skills separately from other learning goals, however, as the diverging experiences of group work may place students in unequal positions in terms of assessment. Although the assessment focuses on the reflective report instead of the jam itself, it can be assumed that a student in a socially harmonious, well-prepared group will have more resources to draw from than a student in a group with social conflicts or lacking in preparations. The former may also be much more motivated to reflect on the game jam and its content than the latter, resulting in a report that does not accurately reflect their learning.

Format constraints

The format of the jam imposed considerable constraints on the participants: they had to work with *Twine* and its limitations, use a specific theme, and the time dedicated to the jam itself was very short. Some students found the use of *Twine* challenging and limiting, and especially in the first instance of the course, reported that a pre-game jam introduction to the tool would have helped in the jam by illustrating what the application is capable of and how to best utilize it. For the second instance, this technical threshold was taken into account and a brief session for familiarizing the students with *Twine* was added into the course schedule. These two quotes from the course journal entries illustrate these concerns:

> I think we could've gotten more out of this if we had had a lecture on the game jam, *Twine*, it's possibilities, what kind of storytelling we want, etc., but now as an introductory to the concept of making your own game, it worked just as fine. (**R10-a**)

> The main challenge of designing this game was figuring out how best to adapt any given element so that it worked with the platform, *Twine*, with the time we had. [...] Since Twine's structure only really allows for one kind of play - making choices based on a list - we had to make similar considerations for the plot. (**R3-b**)

Lack of time was often mentioned as a key challenge in the jam. While some participants viewed it as a positive, it also meant that some students felt they did not have enough time to incorporate their ideas, as well as those discussed on the course, in the game. Active pre-planning helped alleviate time issues, indicating the importance of encouraging or requiring students to pre-plan for the event.

> We did think about the reciprocal quality of games, but in the short amount of time that we had, we did not really have the time to create a storyline open enough for the player to bring one's own input in the progression of the game. (**R4-a**)

> I think it would be interesting to try to design a game where the player's choices truly have more significant consequences, but in this game it was not possible due to the short time afforded to both learning to use *Twine* and to actually develop the story. (**R7-b**)

> Our group met about a week before the game jam lecture to plan a bit. During said meeting we talked through what we were to do with the game - the general plot, how to execute some actual gameplay with *Twine* and our plot and so forth. I think the meeting was extremely helpful for two reasons. It gave us some extra time to work out *Twine* and thus it helped tremendously during the actual game jam by preparing us to push out the (at least mostly) complete game in no time! (**R10-b**)

An interesting challenge stemming from the format was that as a group work exercise, game jam was "too fun". Although this can be seen as something of a positive problem, in some journal entries, the students mostly reported how much fun they had had in the game jam and described their game in detail, with very little reflection on the connection of the game jam to the course content:

> I thought that it was a very interesting exercise in teamwork. We had a lot of fun coming up with the questions, and I already felt like a sauna expert (**R6-a**).

> We had a lot of fun throwing ideas out there and discussing the different possibilities we could include in the game and some funny details as well (**R11-b**).

While definitely encouraging from a perspective of motivation, as evidenced by the theme of *Empowerment* discussed below, this calls into question whether for some students the novelty and fun factors supplant learning and reflection, and underlines the importance of making the learning outcomes of the game jam clear to the students. This phenomenon has previously been identified in the context of game-based learning, with participants focusing on the game rather than the educational content (e.g. Plass, Homer & Kinzer, 2015; Whitton & Mosely, 2014). This also reflects a typical novice problem in game jams, where "throwing ideas out there" is so fun that what can be implemented in a restricted time frame is not properly considered (Zook & Riedl 2013). Consequently, the overall design process may suffer from the misallocation of resources.

On several occasions, the students focused on describing the game they developed, or on reflecting the design process rather than how the course content was utilized in the process. Understandably, by designing games one learns about game design. Especially if the jammer has no previous experience in game design, or design in general, the focus can easily be on learning about the design process itself – which can be cognitively demanding and take the focus away from the subject matter.

> The jam session taught me to think about the creation of a game differently. Even though our game in *Twine* was very simple, developing it illustrated how complicated even the simplest games can be (**R1-a**).

This is something that should be considered when planning to use the jam as an assessment method, such as facilitating reflection on learning and writing about that learning. It is good to be aware of the students' experience in the game design process, but more importantly, to consider how the design process during the jam can be facilitated in such a way that learning about the design aligns with the subject matter. Then again,

learning design thinking and solving ill-defined problems are valuable skills in a sense that they are such problems that people typically encounter in everyday life (Cross, 1982, 225).

Empowerment

For many students, seeing a game they helped to design was reportedly one of the best and most empowering experiences of the course. The dimension of empowerment was especially visible in the ways in which students found their fear of using new technology unfounded (see Meriläinen & Aurava, 2018). While some students initially thought themselves unable to contribute anything relevant to the project, they found their ideas implemented in the game during the jam. In these cases, the students seemed especially proud of the end result.

This can be understood through the dilemma of ill-defined problems (Cross, 1982), as it is difficult to see the end result before it is ready. The findings echo previous research that suggests increased feelings of self-efficacy in first-time game jam participants (Meriläinen, 2019), as these quotes show:

> I was really worried about it [the game jam] beforehand because I had never heard of *Twine*, so I didn't know how it works, and I have no imagination when it comes to designing a multi-faceted, intertwining story. […] This game jam was so much fun and I'm so excited about our game and proud of what we managed to accomplish! Every team member was so valuable to the making of the story! (**R14-a**)

> I love story-centric games myself, as is evident in all my previous journal entries, and having actually created a game like that myself feels incredible. (**R15-b**)

Some of the participants even felt that they would like to design games in the future as well, suggesting a learning and motivational experience not limited to the jam event itself (see Reng, Schoenau-Fog, & Kofoed, 2013; Meriläinen, 2019):

> I hope that for many the game jam is only a starting point into the world of *Twine* stories, as it was for me (**R5-a**).

Although not necessarily something for the instructor to directly assess, the empowerment dimension can be viewed in the context of the student's engagement with the course and its content, as well as their learning motivation. For example, in the first quote above (**R14-a**) it is obvious that the student had overcome their apprehensions regarding the game jam.

In the broader context of assessing the pedagogical impact of the course rather than individual student performance and consideration of when and how to use jams, the empowerment aspect becomes extremely important. By introducing students to a new and exciting method of engaging with digital narratives, the *Twine* jam encouraged and motivated students to further explore the course content, not only in terms of theory, but of

practice as well. It is worth noting that in their course feedback many students reported the game jam being the best thing on an overall enjoyable university course. We interpret this as a vote of confidence for playful approaches in higher education. With a considerable percentage of higher education students in Finland reporting study burnout and lacking resources (Salmela-Aro & Read, 2017), pedagogical methods that empower and motivate students and promote engagement should be further explored.

Discussion

Based on the students' journal entries, a short-format *Twine* game jam can support assessment in a higher education setting, provided it is instructed and planned well such that designing the game, no matter technical proficiency, allows the students to demonstrate their higher learning of the course content. In addition to supporting assessment in the role of, for instance, reflection on learning and learning outcomes, the game jam can serve in a crucial learning function by allowing students to apply theoretical concepts in practice.

In the two instances studied, a short-format *Twine* game jam and its associated reporting prompted students to reflect upon course content and apply it in actual game creation. As a result, the potential of game jams to bridge the gap between theory and practice (Hrehovcsik, Warmelink, & Valente, 2016; Mikami et al., 2016; Pirker, Kultima, & Gütl, 2016) appears not to be limited to the context of studying game development. In both instances studied in this paper, the game jam enabled most students to employ theoretical concepts from the field of literary studies, narrative theory and digital media studies through the crafting of short narrative games. This, combined with other course tasks, allowed the teacher of the course to assess the students' understanding of the said concepts. This suggests that game jamming with *Twine* is indeed a viable method for assessing student learning on a university course. There are, however, limitations which we discuss below, as per our second research question.

Our data indicate that there are issues that need to be considered when using a game jam to support assessment. These are highlighted by the themes of *Diverging experiences* and *Format constraints*. Both address a core issue of assessment: whether the game jam event and related reflection accurately reflect the students' skills and knowledge. Moreover, the instructor or teacher should be aware that things out of a student's control, such as poor group dynamics, may considerably affect the jam experience, which in turn may lead to a report that does not accurately reflect a student's understanding of the subject matter. Similar issues may arise for other reasons, such as technical problems. While *Twine* is a fairly simple platform, technical complications still surfaced. As Gaudl et al. (2018) have pointed out, a technical threshold can shift the focus of the jam from playing with design spaces to technical implementation. This can also result in very different game jam experiences, depending on the technical skills of the group.

Especially in the context of non-game development students, it must be carefully considered whether the learning goals should be focused on subject content or on the participants' personal development and heightened learning motivation (see Meriläinen, 2019). Furthermore, as Goddard, Byrne and Mueller (2014)

have convincingly argued, finding the appropriate balance between the playfulness and gamefulness of the game jam experience and outcomes is crucial for successful game jam facilitation. The more structured, gameful, side of jamming can be facilitated through the clear structure and format constraints, for instance, while facilitating the more experimental, playful, side may pose more of a challenge to the course instructor.

Group dynamics in a game jam setting are very important (Kultima, Alha, & Nummenmaa, 2016), especially for first-time jammers (Meriläinen, 2019). As the students had worked in the same groups throughout the whole course, they did not need to spend time to get to know each other, which may have otherwise hindered the process within such a limited time scale. However, during the two instances of course, it became evident that game jamming is so different from any regular group exercise within the higher education setting that it needs to be introduced as such. The students' ability to function as a group cannot be taken for granted but must be thoroughly instructed so that students can align and identify their skills, goals, and ways of working (see e.g. Kayes, Kayes & Kolb, 2005).

Moreover, in some cases, the analytic approach and reflection on the design process seems to have played a supporting role to the social interaction and enjoyment of the process itself. These may also be called examples of "design by committee", a situation where too many compromises affect the end result. Indeed, some students who worked alone during the first instance of the course had a more analytical take on the assignment, although it is hard to say whether this was due to them working alone or some other factors.

As mentioned above, the game jam was not the only method for assessing the learning of the students in the course: the students wrote an entry into their course journal of each lecture and reading group session. It is also worth mentioning that the entries written on the game jam were in line with the general level of the individual journals (e.g. with regard to the depth of reflection and application of relevant theories). Although most of the students reflected on the course content in their report, some focused on process description over analysis and reflection, a phenomenon previously observed in the context of learning simulations (Vos, 2015).

In our view, game jams potentially complement the existing, more conventional reflective learning methods and thus support reflection-based assessment. They strongly encourage the jammers – in this case, the students – to practically apply knowledge they have acquired, but several variables affect the game jam, resulting in sometimes very different experiences for individual students. Thus, a short-format game jam as described in this study is therefore likely to work better in the role of supporting other forms of assessment than as an only method. However, results suggest that a more extensive, in-depth game jam could have potential for more comprehensive assessment.

All in all, the journal entries suggest that it would be fruitful to examine the data purely from a learning point of view as well, in addition to the assessment angle adopted in this study. Several elements that have been identified in previous game jam learning literature, such as increased self-efficacy (Smith & Bowers, 2016; Meriläinen, 2019), transfer of theoretical knowledge into practical use (e.g. Mikami et al., 2016), and increased

motivation for future learning (Meriläinen, 2019; Reng, Schoenau-Fog, & Kofoed, 2013) were reported by the students despite the very short duration of the jam. The study also supports earlier findings (see Gaudl et al., 2018) that a game jam does not have to be a very long event to serve a learning function, especially with proper scaffolding.

Conclusion

In the context of a course explicitly addressing the properties of digital media, the short *Twine* game jam format proved to be a credible assessment method together with the more traditional ones. As games are an easy way to provide a hands-on experience with storytelling in digital media, the game jam encouraged reflection especially with regard to the design perspective: how the stories must be designed in order to keep up the players' interest, and how the ambition for telling an effective story may clash with the technical limitations, for instance. Furthermore, as part of a playful assessment, game jam allows the various, sometimes surprising ways in which the students may utilize the course contents to surface for assessment.

In order for the game jam to support assessment as possible, the journal entry or similar report written after the game jam needs to be rigorously instructed to encourage the students to focus on reflection instead of description. One approach for this is to ask students to create a short pitch of a game idea for their group – a method typically used in game jams. By instructing them to include, for instance, one or two concepts from the course contents in their idea, the groups can be motivated to discuss and synthesize these concepts into the final game design, as evidenced by our results.

As our data comprised of course journal entries written on two instances of the same course, "Analyzing Storytelling in Digital Media", we were able to compare the entries written in Autumn 2018 and 2019 and see whether certain problems persist or not. These included, most notably, the technical threshold and the need for more detailed instructions on the journal entries on the game jam. While difficulties related to the technical aspects of *Twine* were mostly alleviated by adding a compact session introducing it as a game creation application in the course schedule, the students still should be more thoroughly instructed of game jamming as an exercise in group work. This would potentially contribute to a more reflective attitude towards jamming and thus make game jam an even better tool for evaluating learning in higher education.

Guidelines

- **Have clear goals.** Before deciding upon the game jam as an assessment method in a higher education course, the instructor should carefully consider the reasons for choosing it: what exactly will be assessed through the game jam? Is assessment focused on the jam itself, or the reflection and learning it facilitates? How do the skills learned and utilized during the game jam contribute to the learning goals of the course? Answering these questions will ultimately guide the planning of format constraints of the game jam.

- **Introduce tools beforehand.** *Twine* appears to be an easy application to grasp and a motivating tool for building story games, with little previous knowledge required. Even when using simple tools, instructing students to familiarize themselves with the software beforehand or organizing a short workshop leaves more time for the game creation process itself and helps students plan their game aware of the potential and limitations of the platform. This is especially important in short-format game jams. Although many game jams are built around digital games, non-digital games such as board or card games are also a viable option.
- **Support students and scaffold the learning experience.** The game jam format, and especially the related reflection, requires planning, support and scaffolding from the teacher to fully utilize its benefits. As the event can be exciting and engaging, the fun element can override the reflection. It is therefore important to consider the balance between the more structured (gameful) and the more experimental (playful) aspects of the game jam in advance. While the former can be achieved through careful planning and instructing the students to make use of the course contents, the latter requires social facilitation and certain amount of guidance away from goal-oriented attitudes (e.g. by assessing the jamming process and the consequent reflection instead of the game the groups design).
- **Encourage and facilitate positive social interaction.** Social facilitation is a key element in ensuring a positive game jam experience. As students come into the event with differences in expectations, social skills, and preparedness, these can lead to disagreements in the often hectic, time-constrained situation. The course instructor should facilitate and encourage positive social interactions during the course and point out the importance of social dynamics when the students are forming groups and preparing for the game jam. Students should be encouraged to discuss their expectations, goals, and preferences for the jam beforehand to avoid conflict in the jam situation, e.g. by pitching their ideas for the game to the group.
- **Use game jams to support other forms of assessment.** As the jam experience is contingent on several variables, such as group dynamics, the experiences and resources for reflection can be very different for two individual students. Unless game jamming is comprehensively integrated into the course in terms of both learning goals and working methods, the game jam likely serves better as a supporting rather than a primary form of assessment.

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