

# MoodleStories: Improving Learner Motivation Through Interactive Visual Stories

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**Abstract:** As courses ministered in online environments continue to grow in size and interest, concerns regarding poor academic outcomes and low completion rates remain true. We have developed MoodleStories, a digital storytelling-based solution for improving learning motivation and engagement to compensate for these shortcomings. MoodleStories was developed as an authorship tool available on the Moodle platform. We have devised a Python programming course accompanied by an interactive and thematic comic story about the course. Six participants were interviewed by the end of the course as a validation instrument. Following the interview study, participants showed increased awareness of the activities that dictated story progression and were eager to use MoodleStories in future learning contexts. We argue that MoodleStories expands the design scope and possibilities in applying nonlinear narratives in learning contexts and thus enables the creation of engaging experiences that promote motivation and foster active involvement with coursework.

## 1 INTRODUCTION


In the last years, the growth presented by virtual learning environments (VLEs) seems to confirm their role as one of the major players in global learning. With their creed of open access, initiatives such as MOOCs have garnered interest from students, as the courses provide flexibility and learning opportunities beyond financial and spatial barriers. Nowadays, learners from all over the world can freely enroll in various courses (Qu and Chen, 2015). The growing relevance of MOOCs has also prompted discussion over various topics, such as the benefits it provides and the concerns expressed about those platforms. A recurrent discussed subject is the aspect of retention rates; despite the high number of enrollments, only a small proportion of the students usually manage to graduate (Onah et al., 2014).

Many authors attribute this phenomenon to the challenges in which learners must independently regulate their learning process. Unlike classroom lectures that follow a pre-established schedule, courses ministered in VLEs require that students manage coursework independently. (Lajoie and Azevedo, 2006) found that VLE students often struggle with self-assessment and time management re-

garding course activities. This is emphasized by the research suggesting that successfully graduating in MOOC courses requires learners to be constantly self-assessing. Else, it is common for students to fall into patterns of failing behavior (Hew and Cheung, 2014).

Such challenges have sparked several research that attempts to close this gap in online learning: solutions that employ different mechanisms, as peer comparisons, goal-setting, and gamified systems, arose to promote self-regulatory behavior and aid learners in the achievement of their learning goals. We focus on using digital storytelling techniques for that purpose, which (Benmayer, 2008) argues is a tool that empowers students intellectually, culturally, and creatively. Other authors have verified that the application of digital storytelling as a pedagogical tool is tied to enhancing learner motivation and can thus improve aspects such as retention rates in MOOCs (Chothia et al., 2017; Thirouard et al., 2019).

One format for designing narratives is the so-called “Choose Your Own Adventure” (CYOA) story, in which readers can interact directly with the narrative through choices that can have different outcomes and ramifications (Korber and Shepherd, 2019). These stories put readers in the protagonist’s shoes, providing them with control over the story. CYOA narratives have been previously adapted and used in learning scenarios for improved learner motiva-

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tion and engagement (Chothia et al., 2017; Hand and Varan, 2008). This motivated the conception of MoodleStories, an integrated authoring tool for interactive narratives in Moodle. We propose an approach to narrative interactivity that takes advantage of learner-generated data, such as their activities and interactions in the online environment. Interactivity and “choice” are modeled through how learners interact with coursework, such that the obtained grade in an assignment or the resource accessed can become the driving point for narrative branching and progression.

The stories are presented to the learner through comic-style images displayed directly in the Moodle interface. As the course progresses according to the narrative, learners may receive different panels according to the narrative pathways defined by the author. We argue that MoodleStories operates at the intersection between narrative-based learning enhancement and gamification, a commonly used mechanism to promote increased participation, motivation, and commitment in online learning (Morales et al., 2016).

To validate MoodleStories, we worked on creating a comics-based nonlinear story and implemented it in a self-ran programming course in Moodle. The story puts the learner as the main character, from which different endings can be reached based on a set of graded activities that drive story progression. We conducted interviews with the course participants to evaluate their learning experiences mediated by the narrative. Most showed higher awareness and care when engaging in activities that would drive story progression, and the element of novelty drove increased motivation and eagerness to engage with coursework.

The remainder of this paper is organized as follows. We begin by presenting some of the related literature in Section 2. We then detail the workings and implementation process of the MoodleStories tool in Section 3. Next, Section 4 details the online course and interview study employed for the validation of MoodleStories. Section 5 discusses the contributions, limitations, and opportunities for future research. Finally, in Section 6 we conclude this work.

## 2 RELATED WORK

Many researchers have brought concepts related to storytelling to storytelling in a variety of learning contexts. This section describes some of the research that makes use of these concepts, zooming in on the application of interactive narratives in learning. As such, we briefly detail some of the works we considered to be more closely related to this work.

First, (Dincelli and Chengalur-Smith, 2019) developed a visual CYOA narrative based on comics for teaching and training in cybersecurity education. The approach proposes a contextualized storyline for cybersecurity in which learners can alter the course of the story at specific decision points. On one occasion, the readers are asked whether they would like to read or not the updated privacy policy of an application, which has developments and repercussions in the story. CYOA narratives were also used for learning in the cybersecurity fields, as (Chothia et al., 2017) brought a CYOA narrative with many elements inside a cybersecurity course. Learners are put in the shoes of a new cybersecurity employee inside the story, which needs to complete various tasks and are given choices to progress the story. Each option can lead to the discovery and new story developments. The authors performed qualitative and quantitative evaluations, and the story’s application showed positive results in engagement and motivation.

(Bechkoff, 2019) explores the relationship between gamification and CYOA narrative in experimental research proposing an approach of a game tied with a non-linear narrative for marketing education. The study had students engage in a game based on mystery riddles and interactive answers with branching paths. The work was evaluated, showing increased student engagement and overall performance.

The observed literature indicates that enhancing learner motivation and engagement are some of the prevalent reasons for implementing interactive narrative-based approaches in educational contexts. There are parallels to be drawn on the relationship between learner engagement and interaction in narratives, which empowers learners with agency and control over stories, which can incite more proactive behavior. The support and promotion of proactive learner behavior can positively impact learning engagement, as it can, e.g., result in learners engaging with coursework more often on their own accord. Proactive behavior is one of the components in attaining higher self-regulated learning (SRL) behavior (Zimmerman, 2008), which is an important factor in achieving higher academic outcomes.

## 3 MoodleStories PLUGIN

MoodleStories is a plugin developed for the Moodle learning environment, which enables the creation, design, and presentation of interactive visual narratives. We contextualize MoodleStories as an authorship tool for creating and viewing interactive, nonlinear visual stories integrated with the Moodle environment. Its

main component is the Interactive Narrative Creator, a tool that streamlines the process of conceiving, planning, and quickly deploying CYOA-style narratives directly from the Moodle environment. As opposed to having the learner interact directly with the narrative, such as making choices from a protagonist's point-of-view, the approach proposed by MoodleStories models the interaction as the ways in which a learner can interact with the course. This can include the whole scope of activity tracking covered by the Moodle environment, enabling varied and distinct possibilities for story progression and narrative design. *What score has a learner obtained in this test? How many posts have they made on the forums? Was this resource downloaded?* Questions such as these can become the driving points for story progression in CYOA narratives. This approach extends the design scope for which CYOA narratives can be applied to learning contexts and provides resources to promote student engagement and motivation.

### 3.1 Interactive Narrative Creator

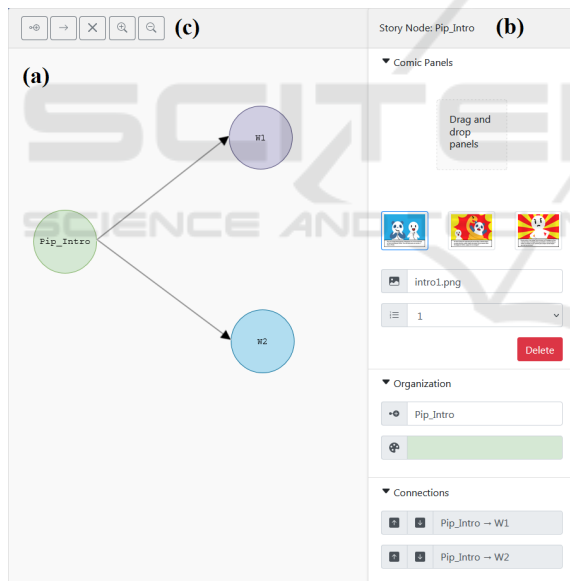


Figure 1: Main interface of the interactive narrative creator: canvas area (a), detail menu (b), and canvas toolbar (c).

The interactive narrative creator is a tool for creating interactive visual narratives in Moodle. Figure 1 presents the main interface. Item (a) denotes the canvas element. The canvas functions as a “drawing board” for designing and laying down the structure for an interactive narrative. The narrative designer can create story nodes and connections onto the canvas, drag, and interact freely with these objects. The canvas toolbar in item (c) provides buttons for creat-

ing story nodes, connections and zooming in and out of objects. Lastly, in item (b), we can see the detail menu, which displays all the data attributes associated with the selected object. It is through the detail menu that users are expected to create and edit customizable attributes, which lay the foundation for narrative progression, design, and deployment. Interactive visual narratives are then conceived through the relationship drawn by the detail menu and canvas objects.

#### 3.1.1 The Story Node Object

Story nodes are the most fundamental elements in the modeling of MoodleStories. They abstract the concept of a continuous segment of a given narrative from beginning to end, functioning as flexible containers for story pathways, enabling systematic ramifications and intersections among segments of the narrative. The story node object carries various data attributes, but the most important structure it carries is the set of panels associated with it. Each story node will necessarily have one or more panels. This set of panels is expected to be part of a continuous segment of a narrative, conveying the visual data of each panel and the order in which they appear in the story. Again, each of the circles-shaped objects in Figure 1 represent distinct story nodes in MoodleStories, along with the detail menu, which displays and enables the editing of associated data. Below we list and briefly explain each data attribute associated with them:

- **Comic panel files:** a set with one or more ordered image files corresponding to a continuous narrative segment.
- **Name:** story node objects can be named to facilitate narrative planning and organization.
- **Color:** story node objects can be customized with different colors for color-coding organization.
- **Connections:** narrative progression is made through the use of connections, and subsequently, conditionals. Section 3.1.2 explains the use of connections in detail.

#### 3.1.2 Connections, Conditions, and Variables

The creation of connections among story nodes is the main mechanism behind story advancement in MoodleStories. Connections follow a format characterized by  $A \rightarrow B$ , with origin and target nodes commanding story advancements. For example, in Figure 1, we have the node `Pip_Intro` connected to the nodes `W1` and `W2`. This structure alludes to previously seen representations of CYOA narratives in literature (Chothia et al., 2017; Dincelli and Chengalur-Smith, 2019).

Story progression is achieved by satisfying the conditions contemplated by each connection originating from the current story node. While this approach can effectively model interactivity as in-course activities, situations in which multiple conditions are satisfied among different node-to-node connections must be handled properly, as they are otherwise conflicting. To address these issues, MoodleStories determines the story progression based on the order in which the connections are specified in the interface. Whenever new connections are created, they are automatically placed below the connections made before them. This functions as a priority list for the order in which these conditions must be tested for story progression.

Once the narrative structure is completed, it can then be deployed to a suitable course. Once deployed, a simple web component that allows the viewing of panels back and forth is displayed in the course header. As such, every learner is presented with their own individual view of the narrative.

## 4 MoodleStories VALIDATION

We evaluated the learning experience mediated by an interactive visual narrative built in MoodleStories by creating an online course. We collaborated with an artist to integrate the narrative into the course, then recruited participants to take part. Interviews were conducted to evaluate the impact of the narrative on the learners' experiences. We explored the different perspectives, experiences, and opinions of the learners in the interviews. In the following sections, we explain the tasks associated with the validation process.

### 4.1 Population and Recruitment

Regarding the population, we had the volunteers adhere to inclusion and exclusion criteria. We determined the criteria based on ethical concerns, goals of the validation, and coursework contents. Thus, the inclusion criteria were participants who had already taken at least one distance education course and had little or no experience with Python programming, as the course's content is introductory. Experience with VLEs was required to ensure the participants did not have problems navigating the course's content. Exclusion criteria were participants under 18 years of age or with physical or cognitive impairments.

Considering the qualitative character of the analysis stage of the interviews, we envisioned a limited sample size. (Boyce and Neale, 2006) argue that a smaller subset of respondents is suitable for in-depth interviews, as it enables the deeper exploration of

their perspectives for a given subjective. Therefore, we planned that the online course, and consequently the interviews, would be conducted with a range of four to eight participants. The recruitment process was done through the social network site Twitter<sup>1</sup>. Once the volunteers manifested interest in participating, they were reached through direct messaging. At the time of contact, the volunteers were handed the consent form for participating in the study, and upon agreement, the participants were considered to be included in the research. The recruitment process lasted eight days, from which we obtained eight volunteers. Each participant engaged with coursework asynchronously, with course completion ranging from 8 to 41 days. In total, 6 out of the 8 participants completed the course.

### 4.2 Online Course Details

Since MoodleStories was designed to deploy stories in contexts of distance education ministered in Moodle, it was necessary to create a suitable scenario for conducting this validation. For this, we first followed the protocol of the Ethics and Research Committee<sup>2</sup>. Then, we planned and formulated the course contents, including lectures, graded activities, and exercises. To reduce the time consumption associated with these tasks, we used the Moodle collection of open courses available for download. It is necessary to select a course subject within our skillsets to exercise the instructor role, as the learners may require assistance with coursework. Thus, we found the course "Python for Beginners 1 - Python Language Basics" in the Moodle Course Directory<sup>3</sup> suitable. The materials were uploaded to our own Moodle instance by using the "Import Course"<sup>4</sup> function and then translated and adapted to Brazilian Portuguese.

### 4.3 Projected Story

We sought to evaluate the impact and repercussions of an interactive story projected with MoodleStories in an online course setting. Thus, we formulated an interactive narrative in MoodleStories. We count on the collaboration of the graphic designer and illustrator Alexandria Troup to bring about the illustrations comic panels of the projected narrative. The

<sup>1</sup><https://www.twitter.com>

<sup>2</sup>Documentation available at <http://plataformabrasil.saude.gov.br/login.jsf> with the CAAE number 22641819.8.0000.5336.

<sup>3</sup><https://moodle.net/resource/d9h0i4td3332-python-for-beginners>

<sup>4</sup>[https://docs.moodle.org/401/en/Upload\\_courses](https://docs.moodle.org/401/en/Upload_courses)

concepts associated with MoodleStories, the tool itself, and the online course contents were introduced and explained to the illustrator. The creation of the story was a joint effort that involved conceptualizing the narrative, drawing the panels, and structuring the narrative in MoodleStories. Given our scenario, motivations, and objectives, we worked from within the following constraints when designing the story:

- The CYOA narrative pathways should be fairly simple to understand, ensuring participants unfamiliar with MoodleStories or CYOA-style narratives can understand the story’s progression and the story-wise implications regarding the results obtained in coursework activities.
- The story must match the course contents, i.e., it needs to be related to the Python programming language, and the concepts throughout the course must appear in the story to reinforce the relationship between the story and the course’s activities.
- Game-like systems should be incorporated into the interactive narrative to address the enhancement of learner motivation.

Thus, we created the comic story “The Adventures of Pip in the World of Python”. The story puts the learner as our protagonist, Pip. Pip’s friend, Panda, is taken away by the evil Python snake. Pip goes on a journey through the world of Python to rescue Panda. Our three characters are named after Python themes: Pip as a reference to the package manager<sup>5</sup>; Pandas being a popular data analysis library<sup>6</sup>; Python being the snake character itself. The choice of introducing Python themes to the story was made to familiarize learners with concepts surrounding the subject and reinforce the relationship between the story and the coursework.

The story’s progression is centered around Pip advancing through the world of Python and conquering different enemies. The comic panels draw inspiration from video games, as the classic platforming video game Super Mario Bros. played a role in the visual presentation of the comics. The story plays on the abstraction of each course lesson corresponding to a new stage, which is done by matching the enemy design to the subjects of the scheduled lesson. For example, when the next lesson is integer data types, Pip faces number-shaped enemies. This dynamic involving game-like stages is presented by the panels depicted in Figures 2, 3, and 4.

The interactivity of the story is drawn by the relationship between the learner’s performance in the

<sup>5</sup><https://packaging.python.org/tutorials/installing-packages/>

<sup>6</sup><https://pandas.pydata.org/>



Figure 2: Introductory comic panel for a given lesson.

course and each lesson’s contents, which correspond to each “level” in the story. Each unit is followed by a graded quiz, the results of which will determine the success of the story (good, average, failure). Figure 3 shows varying degrees of success for the panels corresponding to a given course unit. This nods to the idea of bringing game-like constructs into the interactive story. Different outcomes are possible, such as Pip obtaining a moderate level of success but being unable to collect the coins, or Pip being unable to reach the proposed goal. For every course unit, panels will inform the learners of their current level of performance.



Figure 3: Panel depicting success to clear a lesson module.

The measured success in each level directly influences the story’s outcome, which serves as the primary motivation for the learner to reach a good ending for the story. In the story, Pip sets out on a quest to save Panda, whose outcome is determined by the overall grading in the course. Positive learning outcomes are closed with the happy ending, in which Pip successfully saves Panda as depicted in Figure 4. When the learner fails to achieve the expected grades, Pip is defeated by the snake and fails to save Panda.



Figure 4: One of the possible story endings, in which Pip defeats the snake and saves their friend.

#### 4.4 Interview Study

We interviewed each learner who participated in the study to explore their perspectives, experiences, and thoughts. (Boyce and Neale, 2006) remark that in-depth interviews are “useful when you want detailed information about a person’s thoughts and behaviors or want to explore new issues in depth”. We elaborated a semi-structured questionnaire to guide the interview process as a qualitative data collection instrument. The questions do not target any aspects related to coursework content and are self-contained to the interactions and experiences faced by learners mediated by the interactive narrative. The questions were open-ended to encourage learners to elaborate on their thoughts and to capture the participant’s profile.

Following course completion, we scheduled the interviews with the participants. Each was interviewed without interruption, following the same environment: face-to-face online conversations through video-conference software for 20 to 45 minutes. The participants were reminded of several aspects outlined in the consent form, such as the interview audio recording. The interviews were conducted with a semi-structured script of 15 questions organized into two parts, six questions for capturing the participant’s profiles and nine to evaluate the impact of the interactive visual narrative on their learning experiences.

##### 4.4.1 Participants Profile

All participants stayed in the range of 20 to 31 years old and had at least finished high school. They were either enrolled in undergraduate programs at the moment of the interview or had concluded undergraduate. None of the participants were currently enrolled in graduate programs or had planned to enroll in them.

Questions about their experience with distance learning revealed interesting points regarding the participants. For the most part, participants were already

familiar with the Moodle platform. Some participants had experiences with failing or giving up on online courses, for which each had attributed different reasons for the failure, such as lack of time, interest, pressure, and coursework beyond the level of understanding. A handful of participants had also not failed an online course, and some spontaneously expressed that they had only come in contact with distance learning from within the context of their institutions, having little or no experience with broader MOOC scenarios.

##### 4.4.2 Learning Experience with MoodleStories

The second segment of the interview covered issues related to MoodleStories to capture overall thoughts surrounding motivation and engagement, possible problems, and impact on their learning experiences. As specified by (Boyce and Neale, 2006), we looked for patterns and themes among the participants while paying attention to answers given spontaneously or with enthusiasm to explore the many different perspectives provided throughout the interview process.

Five out of six participants experienced “The Adventures of Pip in the World of Python” and MoodleStories positively. When asked about the effect of the story on their learning, they reported emotional involvement, which led to increased effort in quiz activities. Participants expressed desire to save the Panda character, demonstrating the story’s positive impact on their course experience. However, participants were more engaged only in activities that immediately impacted the story. Other activities, such as posting questions in forums and paying more attention to the lectures were not mentioned. The patterns observed reveal that learners showed emotion and involvement when presented with the story objective, hinting at the importance of having common goals learners can work towards narrative-wise. Furthermore, learners demonstrated awareness and comprehension of the primary mechanism for moving the story forward, the interaction with coursework. However, the observed higher engagement was selective concerning the activities contemplated as narrative pathways. While these findings hint at the MoodleStories approach to interaction in the narratives positively fostering higher engagement, it also highlights caveats in narrative design for this approach to be explored.

When asked about motivation, four participants described how the presence of the story affected how they engaged with the course. One participant said that novelty kept them more interested and motivated to engage with coursework. As the comic panels were added incrementally following activity completion, they expressed eagerness to engage and progress

more quickly with the coursework to visualize the new comic panels sooner. The narrative granted a game-like element to the online course, which corroborates with some viewpoints found in research that argue interactive narratives bring an element of gamification to the courses (Chothia et al., 2017).

Regarding the approach used for narrative interactivity, all participants understood the mechanism. However, a few concerns were voiced throughout the interview. While the means for story progression were described as “easy to understand”, further inquiring showed the mechanism was not quite as clear as intended. Two participants claimed to rely on forum explanations and previous direct messaging to understand how to interact and progress in the story, as just the initial story prompt does not immediately clarify how to interact with the story. This suggests a need for a tutorial or explanatory notes to support understanding the workings behind each narrative.

All participants considered the presented comic to be of appropriate length for the course size. The narrative was designed with the course contents in mind, and the panels provided direct feedback to the learners, informing them of the next activity. None of the learners thought that the comic panels were distracting or intrusive in the Moodle environment. Two mentioned that the comic stories were short and did not feature significant amounts of reading. These findings seem to reaffirm some arguments made by (McCloud, 2006) regarding comics, as they enabled quick reading and fast identification with readers.

The participants reacted positively to the presence of MoodleStories and would consider enrolling in other courses employing interactive narratives. Three remarked that they wished other online courses would employ “fun” teaching methodologies. Two participants were enthusiastic about implementing such narratives in future courses. One significant takeaway was that learners could interact and understand the mechanism for story progression, albeit with guidance, which validates one of the fundamental and novel elements of MoodleStories.

## 5 DISCUSSION

This section discusses our main contributions and the limitations of the proposed solutions and analysis and enumerates the opportunities for future research.

### 5.1 Contributions

The conduction of research process has covered interactive storytelling for motivation and engagement.

We summarize our research contributions in the development of MoodleStories, and its validation with “The Adventures of Pip in the World of Python” in an online Python course.

MoodleStories presents a new way to create and integrate interactive visual narratives in online Moodle courses. We argue that the approach proposed to interactivity should enable instructors to create engaging learning experiences that foster motivation and positive engagement with coursework. Integrating “The Adventures of Pip in the World of Python” in an online programming course has allowed us to look at the repercussions created by the interactive narrative among six participants. The participants showed emotional involvement with the story and higher awareness when performing activities that directly impacted the narrative. The analysis of the interviews also revealed some caveats in narrative design for MoodleStories, as participants commented, e.g., on factors of narrative length and story prompts as motivators. In this context, MoodleStories also presents research opportunities in creating and incorporating these narratives. Next, we acknowledge some of the limitations in this work and expand on the possibilities for future work.

### 5.2 Limitations and Future Work

In its current form, MoodleStories enables the planning and projecting of interactive narratives with functionalities offered by the node elements, pathways, and environment conditionals. However, it does not eliminate the need for artistic skills to conceive a narrative, which may often lie outside the skills expected of an education professional. This limitation may restrict the applicability of MoodleStories due to logistical and financial hurdles. We see two ways going forward with MoodleStories. First is the elaboration and integration of a collaborative comic story repository through which users could upload and share their creations, enabling other users to download this creation and adjust the node configuration, pathways, and conditions to suit their online course. However, for broad adoption, the contents of the uploaded stories would have to be in large part “generic” (e.g., non-course specific), and there are significant challenges regarding organic growth of the repository. Another possible way forward is implementing a panel-creation interface with pre-made 3D assets to streamline the tasks of panel creation. This approach could be effective to lower the hurdle of the skill necessary to create comic panels. Both proposed approaches present feasible opportunities for the advancement of the MoodleStories tool.

Lastly, MoodleStories could benefit from a larger-scale quantitative evaluation. MoodleStories could be implemented for a subset of learners in a real-world online course scenario while another group continues to operate without it. This experiment would enable us to compare the performance of both groups in various aspects, such as academic achievement, time spent, and amount of community interactions. Further estimating the impact of MoodleStories on learning outcomes, student engagement, and learning motivation is an important step toward its broader applicability and adoption in real-world scenarios. These evaluations are to come in future work.

## 6 CONCLUSION

As online courses continue to grow in relevance and interest, so does the demand for solutions that mitigate or improve certain aspects of online learning. The research on SRL-based implementations contemplates a wide scope of learning's cognitive, behavioral, motivational, and emotional aspects. We use interactive storytelling to develop MoodleStories, an integrated tool for creating and viewing interactive, nonlinear stories in Moodle. Our approach using activity tracking data provided by the VLE brings the question of learner engagement to the forefront and presents opportunities to expand the design scope in incorporating narratives in online courses. Through the validation process, we could verify how learners reacted and interacted with the story in an online course environment. This process helped reveal important details regarding how activities that configure story progression are perceived differently, and brings up questions such as how emotional involvement with the stories can impact engagement with coursework. These factors hint at how differences in narrative design can influence underlying aspects of the learning process and highlight possible pathways in future research on creating and integrating interactive narratives in courses using MoodleStories.

## REFERENCES

- Bechkoff, J. (2019). Gamification using a choose-your-own-adventure type platform to augment learning and facilitate student engagement in marketing education. *Journal for Advancement of Marketing Education (JAME)*, 27(1).
- Benmayor, R. (2008). Digital storytelling as a signature pedagogy for the new humanities. *Arts and Humanities in Higher Education*, 7(2):188–204.
- Boyce, C. and Neale, P. (2006). *Conducting in-depth interviews: A guide for designing and conducting in-depth interviews for evaluation input*. Pathfinder International, Boston.
- Chothia, T., Holdcroft, S., Radu, A.-I., and Thomas, R. J. (2017). Jail, hero or drug lord? turning a cyber security course into an 11 week choose your own adventure story. In *2017 USENIX Workshop on Advances in Security Education (ASE 17)*, Vancouver. USENIX Association.
- Dincelli, E. and Chengalur-Smith, S. (2019). Choose your own hacking adventure: Contextualized storytelling to enhance security education and training. In *Proceedings of the 15th Symposium on Usable Privacy and Security (SOUPS)*.
- Hand, S. and Varan, D. (2008). Interactive narratives: Exploring the links between empathy, interactivity and structure. In Tscheligi, M., Obrist, M., and Lugmayr, A., editors, *Changing Television Environments*, pages 11–19, Berlin. Springer Science and Business Media LLC.
- Hew, K. F. and Cheung, W. S. (2014). Students' and instructors' use of massive open online courses (MOOCs): Motivations and challenges. *Educational Research Review*, 12:45–58.
- Korber, I. and Shepherd, J. (2019). Teaching the information literacy framework. *Reference Services Review*, 47(4):461–475.
- Lajoie, S. P. and Azevedo, R. (2006). Teaching and learning in technology-rich environments. In *Handbook of Educational Psychology*, chapter 35. Routledge, Oxfordshire.
- McCloud, S. (2006). *Making comics: storytelling secrets of comics, manga and graphic novels*. Harper, New York, 1st ed edition. OCLC: ocm71338724.
- Morales, M., Amado-Salvatierra, H. R., Hernández, R., Pirker, J., and Gütl, C. (2016). A practical experience on the use of gamification in MOOC courses as a strategy to increase motivation. In Uden, L., Liberona, D., and Feldmann, B., editors, *Learning Technology for Education in Cloud – The Changing Face of Education*, pages 139–149, Cham. Springer International Publishing.
- Onah, D. F., Sinclair, J., and Boyatt, R. (2014). Dropout rates of massive open online courses: behavioural patterns. *EDULEARN14 proceedings*, 1:5825–5834.
- Qu, H. and Chen, Q. (2015). Visual analytics for MOOC data. *IEEE Computer Graphics and Applications*, 35(6):69–75.
- Thirouard, M., Cahagne, C., Bernaert, O., and Jehl, D. (2019). Storytelling and innovative digital techniques which increase motivation levels of MOOC participants. In *Lecture Notes in Computer Science*, pages 178–188. Springer International Publishing.
- Zimmerman, B. J. (2008). *Goal setting: A key proactive source of academic self-regulation.*, pages 267–295. Motivation and self-regulated learning: Theory, research, and applications. Lawrence Erlbaum Associates Publishers, Mahwah.