Digital Storytelling through Teamwork Gamification Model to Encourage Innovative Computer Art

Wannaporn Chujitarom

Rangsit University, Pathumthani, Thailand

Abstract – The purpose of this research is: (1) to develop digital storytelling through the use of teamwork gamification model to encourage innovative computer art; (2) to evaluate the model; and (3) to study the results in terms of innovative computer art. The sample group are 6 experts in related fields, and 35 undergraduate students. The research results showed that: (1) the model consists of 4 elements; Input Factors, Digital Storytelling through a Teamwork Gamification Process, Innovative Computer Art Evaluation, and Feedback; (2) the results from evaluation of the model indicates that it is appropriate at the highest level ($\bar{x} = 4.62$, S.D. = 0.62); and (3) the results in terms of the innovative computer art were at the high level.

Keywords – Digital storytelling, Teamwork, Gamification, Computer Art, Innovation.

1. Introduction

The world in the 21st Century is driven by innovation. There is a need to stimulate the economy and to keep up with the developing technology, such as by reducing costs, saving production time, increasing productivity and export sales based on such advances in technology. Innovation is therefore a very important aspect throughout industry, including the computer art industry.

DOI: 10.18421/TEM92-18

<https://doi.org/10.18421/TEM92-18>

Corresponding author: Wannaporn Chujitarom,
Rangsit University, Pathumthani, Thailand.

Email: wannaporn.c@rsu.ac.th

Received: 25 February 2020.

Revised: 08 April 2020.

Accepted: 16 April 2020.

Published: 27 May 2020.

© 2020 Wannaporn Chujitarom; published by UIKTEN. This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 3.0 License.

The article is published with Open Access at www.temjournal.com

Computer art is a combination of computer science and art. We now see modern art as never before, such as in movies with special effects or computer graphics (CG), animation, etc. The CG has to be added in order to ensure a perfect integration between computer programs and art [1]. One of the important connections is storytelling.

Storytelling can be thought of as the core of computer art. This is because it has the duty to coordinate the parts of a whole story in order to communicate effectively with viewers. It does this by seamlessly stitching stories together using digital techniques such as video clips, digital painting, comic illustrations and animation, etc. [2]. Digital storytelling consists of 6 steps as follows: 1. Write, 2. Develop Script 3. Create Storyboard, 4. Locate Resources, 5. Create, and 6. Share [3]. The key skills of the 21st Century are digital literacy, the ability to communicate with the community, debate, and knowledge acquisition [4], innovation, and the development of collaboration skills or teamwork.

Teamwork can make a group of people successful, and is considered one of the keys to success in every profession. Therefore, teamwork can be used to help drive computer art innovation. Teamwork and digital storytelling are closely related, because good stories have to arise from communication from the narrator to the audience, and as a result of feedback. Working as a team makes the digital storytelling process very successful [5]. Another factor that will help accomplish such a mission is gamification.

Gamification is the most popular strategy in existence today. It is both economic and educational. By using game methods in a particular context, such as selling products and accumulating points, it will encourage customers to come back and buy at the same store. This can involve redeeming rewards involving accumulating points as required, or the accumulation of points by students who consistently submit good homework throughout the semester, and by showing the leader scores to classmates. Therefore, this encourages them to be active and alert with regard to the need to study. With these gamification techniques, the users will be able to encourage more consumers or learners to participate

in activities, and be more inspired. Gamification consists of the following elements: 1. Points, 2. Level, 3. Badge, 4. Leaderboard, 5. Reward, and 6. Achievement [6].

The features that are essential for effective teamwork are as follows: 1. Commitment to team success and shared goals, with team members having common goals. They need to strive for team success, to be motivated, participate and be determined to achieve the highest level. 2. Interdependence. Team members have to participate. Working interdependently as opposed to independently is the best thing for each individual, allowing the team to achieve its goals at a high level. 3. Interpersonal Skills. It is important to promote a caring work environment, to be able to honestly discuss issues, to provide mutual support, and to show respect and commitment to the team and to the individual. 4. Open communication and positive feedback. There is a need to listen to complaints and the needs of team members. Members must be willing to give and receive constructive criticism and offer real suggestions. 5. Appropriate team composition is essential in the creation of a successful team. Team members have to all understand the role of teamwork. 6. Commitment to team processes, leadership & accountability. Team members are responsible for participating in the team. Effective leadership is essential for team success, including joint decision-making and problem-solving [7].

Innovation is one of the keys to the 21st Century. It is necessary to stimulate the economy and the development of education, and it will enable the society of industrial countries to develop in the world context. Innovation is the creation of knowledge from many sciences leading to the creation of new things that have never been seen before. It can be used to reduce costs, reduce time needed for production, and increase productivity. It can make human work easier, and it has to be accepted by the people in any industry that is affected. Innovation is therefore an indicator of the vision, and it is this vision working at the cutting-edge of organizations and societies that create change [8]. Innovation relates to new goods and services resulting from the use of knowledge and creativity. There are 3 components of innovation: 1. Originality this refers to a new good or service that has been developed. These can be developed from an earlier version or can newly develop. 2. Economic or Social Benefits. These can refer to economic benefit, or the creation of some commercial success. That is, innovation has to be able to create added value, as a result of the development of new things. The benefits can be measured directly in monetary form. Socially however, such value creation cannot be measured in monetary terms. 3. Knowledge and Creativity. These

involve the use of knowledge and creativity as the basis for new development. These do not result from imitation of duplication [9], [10].

Innovative Computer Art is the creation of new forms of computer art, aimed at reducing production time, increasing the efficiency of creation, and creating new output. This is an important tool in the development of classroom learning in the 21st century, [11] through the use of gamification involving teamwork. The aim is to create a model and an associated learning process in order to create an innovative computer art, and to ensure that it can be practically applied in the computer art industry in this digital era.

2. Objectives

The objectives of this research are: (1) to develop a digital storytelling through teamwork gamification model to encourage innovative computer art; (2) to evaluate the model; and (3) to study the results in terms of computer art innovation.

3. Research Scope

The sample group is divided into two sub-groups. The first sub-group is made up of 6 experts in related fields, in the field of digital storytelling, teamwork, gamification, computer art, innovation and instructional design. Each has at least five years' experience, and was selected using the purposive sampling method. The second sub-group consists of 35 undergraduate students from the Faculty of Digital Art, Rangsit University, by using a random sampling method. Tools for evaluation are the arithmetic mean and standard deviation.

4. Research Framework

The independent variables were digital storytelling, teamwork, gamification, computer art, innovation, instructional design and the Digital Storytelling through Teamwork Gamification Model. The dependent variables were the Innovative Computer Art. See in Figure 1.

Figure 1. Research Framework

5. Research Methodology

The research methodology can be divided into four phases.

Phase 1 was the development of a digital storytelling through teamwork gamification model to create computer art innovation. This included: 1. the study of theories and related research; 2. analyzation and synthezation of a research framework; 3. design and development of a model, mainly focused on digital storytelling, teamwork, gamification, computer art, innovation and instructional design; and 4. establishing a measuring tool, divided into 2 parts. Part 1 is a model assessment form using a Likert scale of five levels of measurement, consisting of 'Strongly agree', 'Agree', 'Neither agree nor disagree', 'Disagree' and 'Strongly disagree'. Suitability was assessed through analysis using mean ($\bar{x}$) and standard deviation (S.D.). The criteria for suitability were as follows: 1.00-1.80 indicates lowest, 1.81-2.60 indicates low, 2.61-3.40 indicates medium, 3.41-4.20 indicates high and 4.21-5.00 indicates highest. Part 2 is a computer art innovation assessment form in the form of a questionnaire. This consists of 3 questions about the computer art innovation product outcome and has 2 options 'Yes' and 'No': the questions relate to Originality, Economic or Social Benefit and Knowledge and Creativity Ideas. Assessment involves the use of the mean ($\bar{x}$) and the standard deviation (S.D.). Set values as a percentage from all the samples, is obtained by dividing the criteria as follows: less than 59 percent indicates lowest, 60-69 indicates low, 70-79 indicates medium, 80-89 indicates high and 90-100 indicates highest.

Phase 2 is the evaluation and certification of the digital storytelling through teamwork gamification model to encourage innovative computer art. This included: 1) submitting the model to 6 experts for evaluation in terms of its suitability. They all work in related fields in the form of digital storytelling, teamwork, gamification, computer art, innovation and instructional design. Each has at least five years' experience, and was selected using the purposive sampling method. 2) Developing the model according to the experts' suggestions; and 3) synthesizing the model in the form of a diagram.

Phase 3 involved the implementation of the model using a sample group consisting of 35 undergraduate students, academic year 2018, Faculty of Digital Art, Rangsit University. They were asked to tell a story to each other by interpreting the lyrics of a song. The same song was used for the whole group. Each person could tell their story in a creative way, involving any characters, according to their personal idea. Therefore, they all acted as a storyteller, which is part of element 1: Input factors. For element 2: Digital storytelling through the teamwork

gamification process, they were asked to create a story through the process of digital storytelling; 1. Write, 2. Develop a Script, 3. Create a Storyboard, 4. Locate Resources, 5. Create and 6. Share. At the same time they are working in the gamification environment. This will provide them with: 1) Points 2) Levels 3) Badges 4) Leaderboards 5) Rewards and 6) Achievement. They were also determined to work as a team by having a commitment to team success and shared goals, being interdependent, demonstrating interpersonal skills, demonstrating open communications and giving and receiving positive feedback, understanding the appropriate team composition is essential in the creation of a successful team and having a being committed to team processes, showing leadership & accepting accountability. The assignment is that everyone has to write a story and start creating a short animation based on their own creative ideas, one sentence per song. Everyone then brought the short animation together and combine the whole song. The output is one long music animation video that everyone has participated in by thinking and creating one sentence each. This saves time when it comes to creating a long music animation video. Element 3 is the computer art innovation aspect. This consists of three factors associated with computer art innovation. These are; 1. originality, 2. economic or social benefits, and 3. knowledge and creative ideas. Element 4 consists of feedback from the audience.

Phase 4 is the measurement of the computer art innovation. The 35 students who make up the sample will have an opportunity to watch the montage animation, which is the computer art innovation output from the developed model. After that, they will complete the questionnaire, which has 2 options 'Yes' and 'No', consists of 3 questions about innovative computer art product outcome: Originality, Economic or Social benefit and Knowledge and Creativity Idea. Assessment is done using the mean ($\bar{x}$) and standard deviation (S.D.). Values are set as a percentage from all samples. This is done by dividing the criteria as follows: less than 59 percent indicates the least amount of Computer Art Innovation, 60-69 indicates a low degree of Computer Art Innovation, 70-79 indicates a medium degree of Computer Art Innovation, 80-89 indicates a high degree and 90-100 indicates the highest degree of Computer Art Innovation.

6. Findings

The research findings are presented in three parts. At Part One, the development of digital storytelling through the use of a teamwork gamification model to create Computer Art Innovation. The model contains four elements.

The first element is the input factors consisting of Storytelling. Every student will demonstrate their creativity by telling one story.

The second element is digital storytelling through the teamwork gamification process. This consists of three components. Component 1 is the Gamification Element, including: 1. Points, 2. Levels, 3. Badges, 4. Leaderboards, 5. Rewards, and 6. Achievement. Component 2 is the Digital Storytelling Process. This includes the following steps: 1. Write, 2. Develop Script, 3. Storyboard, 4. Locate Resources, 5. Create and 6. Share. Component 3 involves Teamwork, and includes: 1. Commitment to team

success and shared goals, 2. Interdependence, 3. Interpersonal Skills, 4. Open Communication and Positive Feedback, 5. Appropriate teamwork and 6. Commitment to team processes, leadership and accountability.

The third element relates to the computer art innovation evaluation. This consists of three components: 1. Originality, 2. economic or social benefit and 3. knowledge and creativity in terms of ideas.

The fourth element consists of feedback from the audience. See the diagram in figure 2.

Figure 2. Digital Storytelling through Teamwork Gamification Model to Encourage Innovative Computer Art

Part Two is the results of the evaluation of the digital storytelling developed through the teamwork gamification model to create computer art innovation. The evaluation was carried out by submitting the developed model to the 6 experts for certification of the suitability of its elements. The results showed that all 6 specialists agreed that the elements of the developed model were at the highest and most

appropriate level ($\bar{x} = 4.60$, S.D. = 0.62): element one, Input Factor ($\bar{x} = 4.50$, S.D. = 0.83); element two, Digital Storytelling through Teamwork Gamification Process ($\bar{x} = 4.83$, S.D. = 0.30); element three, Innovative Computer Art Evaluation ($\bar{x} = 4.60$, S.D. = 0.52); and element 4 Feedback ($\bar{x} = 4.50$, S.D. = 0.83). That is shown in table 1.

Table 1. Arithmetic mean and standard deviation results from 6 specialists

Elements and Components	($\bar{x}$)	(S.D.)	Suitability
Elements 1 Input Factor			
Storytellers	4.50	0.83	Highest
Sum of Elements 1	4.50	0.83	Highest
Elements 2 Digital Storytelling through Teamwork Gamification Process			
Gamification Element	4.66	0.51	Highest
Digital Storytelling Process	5.00	0.00	Highest
Teamwork	4.83	0.40	Highest
Sum of Elements 2	4.83	0.30	Highest
Elements 3 Innovative Computer Art			
Originality	4.50	0.54	Highest
Economic or Social benefit	4.66	0.51	Highest
Knowledge and Creativity Idea	4.66	0.51	Highest
Sum of Elements 3	4.60	0.52	Highest
Elements 4 Feedback			
Analysis Feedback	4.50	0.83	Highest
Sum of Elements 4	4.50	0.83	Highest
Results	4.60	0.62	Highest

Part Three is the implementation. Students have created a short animation based on their own storytelling, and they have combined them. The short animations are then transformed into a full-length animation music video as a montage, consisting of many characters and with the narrative from the 35 storytellers. The whole animation music video has to tell the story of the lyrics smoothly. During the animation production process, students have an opportunity to collect points and show on the leaderboard. However, they also have to work as a team, to share their knowledge and solve problems together. The students are engaged in the animation production process over a period of one week. This means that they have to use time productively and budget for the production, which normally would take one month for such a full-length animation music video. The montage animation music video is a new way of digital storytelling. It is created by mixing each short character story together, and connecting the story by using the lyrics of a song. During the teamwork production process, the students have the opportunity to share their knowledge and reflect on

their comment. As a result, the students get many creative ideas through the teamwork gamification process.

Part Four is the result of the computer art innovation process using a questionnaire to obtain data. The students watched the montage animation music video, which is the computer art innovation output developed from the model. They then answered the three questions in the questionnaire, each of which has 2 options 'Yes' and 'No'. The results are as shown in Table 2 and figure 3-5.

Table 2. Innovative Computer Art Evaluation

Topics	'Yes'	'No'	Degree of Innovative Computer Art
Originality	94.30 %	5.70 %	Highest
Economic or Social benefit	68.60 %	31.40 %	Low
Knowledge and Creativity Idea	85.70 %	14.30 %	High
Result	82.86 %	17.13 %	High

Figure 3. Originality Percentage

Figure 4. Economic or Social benefit Percentage

Figure 5. Knowledge and Creativity Idea Percentage

The results of the evaluation of the computer art innovation from the sample of 35 students answering the questionnaire were that it was of the high level at 82.86%. The montage animation music video as an innovative computer art, in terms of 'Originality' was at 94.30 %, indicating 'Highest', 'Economic or Social Benefit' at 68.60%, indicating 'Low' and 'Knowledge and Creativity Ideas' at 85.70%, indicating 'High'.

7. Discussion

All 6 experts agreed that the digital storytelling method emerging through the use of the teamwork gamification model could be used to create digital art innovation at the highest appropriate level ($\bar{x} = 4.60$, S.D. = 0.62). The Innovative Computer Art Product was of the high level at 82.86%. In accordance with Pornsawan, Wannapiroon and Nilsook (2019) [6], Gamification can promote innovative skills. Similarly, as shown by the Popadiuk, Silvio and Chun (2006) [9] research, knowledge creation can relate to innovation, the results also relate to the work of Tarricone and Luca (2002) [7] who found that teamwork encourages success. Jantakoon, Wannapiroon and Nilsook (2019) [12] and Bernard (2008) [4], discovered that digital storytelling is very good at being able to develop learning.

8. Conclusions

The digital storytelling through teamwork gamification model as it is used to encourage innovative computer art contains 4 elements. Element 1 is input factors consisting of Storytelling. Element 2 is digital storytelling through the teamwork gamification process, and it consists of 3 components. Component 1 is the Gamification Element, Component 2 is the Digital Storytelling Process, Component 3 relates to Teamwork. Element 3 is the innovative computer art evaluation, which consists of 3 components: 1. Originality, 2. Economic or Social Benefit, and 3. Knowledge and Creativity. Element 4 involves feedback.

All 6 Experts agreed that the developed model is at highest appropriate level in terms of creating computer art innovation.

The 35 students in the sample agreed that output from the developed model is at the high appropriate level in terms of enhancing innovative computer art.

From all findings, it can be concluded that the application of digital storytelling to gamification and to teamwork can lead to good quality innovative computer art. This can save production time, minimize the budget, increase productivity, encourage originality and be beneficial to today's economy.

Digital storytelling, gamification and teamwork can be used to create innovative computer art. This will help developing the digital economy in many ways. Can computer art innovation be used to promote multiculturalism, and cross cultural boundaries, and appeal to different nationalities? That is the question for future research.

References

- [1]. Lopes, D. (2009). *A philosophy of computer art*. Routledge.
- [2]. Chujitarom, W., & Wannapiroon, P. (2018). Development of STEAM Digital Storytelling Model to Create Digital Economy Innovation for Art Education. *The International Journal of Design Education*, 12(4), 55-62.
- [3]. Jakes, D. S., & Brennan, J. (2005). Capturing stories, capturing lives: An introduction to digital storytelling. Retrieved from: http://id3432.securedata.net/jakesonline/dst_techforum.pdf [accessed: 16 January, 2020].
- [4]. Robin, B. R. (2008). Digital storytelling: A powerful technology tool for the 21st century classroom. *Theory into practice*, 47(3), 220-228. <https://doi.org/10.1080/00405840802153916>
- [5]. Cunsolo Willox, A., Harper, S. L., Edge, V. L., 'My Word': Storytelling and Digital Media Lab, & Rigolet Inuit Community Government. (2013). Storytelling in a digital age: digital storytelling as an emerging narrative method for preserving and promoting indigenous oral wisdom. *Qualitative Research*, 13(2), 127-147. <https://doi.org/10.1177/1468794112446105>.
- [6]. Pornsawan, P., Wannapiroon, P., & Nilsook, P. (2019). Imagineering Gamification on Cloud Technology to Enhance the Innovative Skill. *International Journal of e-Education, e-Business, e-Management and e-Learning*. 9 (2): June 2019 <https://doi.org/10.17706/ijeeee.2019.9.2.123-130>.
- [7]. Tarricone, P., & Luca, J. (2002). Successful teamwork: A case study, in Quality Conversations. *Proceedings of the 25th HERDSA Annual Conference*. Perth, Western Australia, 7-10 July 2002, 640-646.
- [8]. Kline, S. J., & Rosenberg, N. (2010). An overview of innovation. In *Studies On Science And The Innovation Process: Selected Works of Nathan Rosenberg* (pp. 173-203).
- [9]. Popadiuk, S., & Choo, C. W. (2006). Innovation and knowledge creation: How are these concepts related?. *International journal of information management*, 26(4), 302-312.
- [10]. Tang, H. K. (1998). An integrative model of innovation in organizations. *Technovation*, 18(5), 297-309.
- [11]. Sheng, K.C. (2007). Art Education Technology: Digital Storytelling. *Art Education*, 60(2), 17-22. <https://doi.org/10.1080/00043125.2007.11651632>
- [12]. Jantakoon, T., Wannapiroon, P., & Nilsook, P. (2019). Virtual Immersive Learning Environments (VILEs) Based on Digital Storytelling to Enhance Deeper Learning for Undergraduate Students. *Higher Education Studies*, 9(1), 144-150.