

STORYTELLING APPLICATION BASED ON INTERACTIVE STORY GRAPH STRUCTURE (ISGS)

Hayati Abd Rahman^{1*}, Azrina Ashaari² and Nur Azima Alya Narawi³

Faculty of Computer and Mathematical Sciences,

Universiti Teknologi MARA (UiTM), Shah Alam, MALAYSIA

^{1*}hayatiar@tmsk.uitm.edu.my, ²rinaashaari@gmail.com, ³azimaalya94@gmail.com

ABSTRACT

Storytelling is a process of conveying series of events and information in words, images, and sound. Conventionally, storytelling developers/writers will apply the linear narrative structure approach to deliver the stories. However, that approach has some limitations; users cannot determine the path to end the story. They have no option to choose how to end the story based on their way of storytelling. Therefore, this study is about applying an Interactive Story Graph Structure (ISGS) approach to storytelling. ISGS approach is a structure used in storytelling in which users can revert their decision when going through the storytelling application implemented during the development. After completing the storytelling prototype development, a survey was conducted to test users' enjoyment level when using the prototype. The survey was divided into four constructs: expectation, ease of navigation, understanding, and satisfaction. There were 36 respondents, and the data were collected on a random basis. Based on the survey's result, most users (90.28%) enjoyed the storytelling application. The storytelling prototype was developed using Adobe Animate Creative Cloud and has been distributed among the respondents randomly. The analysis was conducted to determine the findings, limitations, and recommendations for future project improvement based on the results obtained. This study's outcome is the complete production of storytelling application, which is creative and interactive with ISGS.

Keywords: *Interactive Story Graph Structure, Storytelling application, User Enjoyment*

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1. Research Background

Storytelling is a way to deliver content to the audience by using fact and narrative (Rebecca & Derek, 2020). The stories may be in facts or improvised to understand the important message of the stories. The interactive narrative in storytelling indicates the interaction between users and the story. The difference between interactive narrative and other digital entertainment approaches is that it allows users to operate to alter the storyline's ending (Riedl & Bulitko, 2012), which is in line with today's trend. Currently, there are many interactive storytelling applications available on the internet. Ross-Barrett (2017) showed that the interaction benefits engagement and learning outcomes. Many story applications, educational materials, and self-help resources provide the opportunity for potential publishers to explore. The interactive media and narrative are also continually growing and changing. Good storytelling is based on a good narrative structure.

In this research, the Interactive Story Graph Structure (ISGS) has been used to help users revert the decision applied in the storytelling structure. Users have more freedom of control in altering the destination/ending of stories. Riedl *et al.* (2003) added that interactive

narrative systems must have a good quality of storytelling experience and balance the story's consistency and the number of controls provided for users.

Typically, a linear narrative structure approach will be used in most storytelling application. However, this approach has some limitations in which users cannot choose options to determine the path to end the story. Moreover, the storyline cannot be reverted if users want to change their story path's decision. Wardrip-Fruin & Mateas (2017) mentioned that a new academic discipline called computational media is creating a new form of interactive storytelling determined by users' options. Ross-Barrett (2017) also emphasised the interactive narrative approach that offers users some interactions by restraining the users' decisions to make within a framework, limiting the users' creativity.

The level of interactivity in storytelling affects users' engagement. The freedom to control and experience the different story flow may contribute to the users' engagement throughout the storyline in storytelling. The storytelling structure needs to be improved to allow for flexibility to revert the storyline's options. An example of a story was taken from a storytelling application entitled Emily Is Away (released on the web since 2015). It is an indie visual novel game consisting of a limited number of users' choices to decide their options for the story ending. Throughout the storyline, users ran out of options, forcing to conclude the ending, resulting in the failing relationship between the protagonist and Emily. Psychologically, users who could not accept the ending of the story would get frustrated because of the bad ending. Unless they were given a second option to undo their decision made earlier, this situation could be overcome by applying the ISGS in storytelling structure.

Conventionally, storytelling developers/writers will apply the linear narrative structure approach. Riedl & Young (2006) stated that linear narrative is the most basic form of a narrative. The arrangement of the events of the stories is portrayed from beginning to ending without any interaction with users, changing the flow and the ending of the stories. Besides, the storyline cannot be reverted if users suddenly want to change their story path. A study carried out by Narawi *et al.* (2020) showed that linear narrative structure is lacking in certain aspects, such as moving in a flexible structure, flashback and repetition, interactivity, and multiple options, compared to story graph.

The users may face some situations in which they have limited interactivity in the storytelling, influencing the users' enjoyment. Therefore, the interactive narrative structure needs to be improved to provide a platform for the storytelling developers/writers to produce storytelling that can offer more opportunities to users and give them more freedom to control and experience the story's different flow. Moreover, users can also revert the decision made when going through the storyline.

2. Method Used

The ISGS (Narawi *et al.*, 2020) is a storytelling structure that can describe the whole flow of storyline interactively. The structure consists of interactivity, iteration, and multiple options symbols. ISGS is applicable for a storyline containing two or more options provided at the climax and ending part of the story, making the flow of the story structure easier to be created. The multiple option symbol is a kind of selection used to provide two or more options in every story node in the storyline. It allows users to be able to discover different story endings upon clicking one of the options provided.

2.1 Interactive Story Graph Structure (ISGS)

Figure 1 shows a storytelling structure using ISGS, depicting the entire flow of a storytelling prototype. It consists of three scenes with two or more options. The ISGS gives the users more options to choose the storyline with different story destinations by providing multiple options and iteration symbols. The iteration structure is denoted as RS, and RF symbol denotes a repetitive of a single or full path in one scene. The iteration structure represents the

reverse/backward process in the story. Table 1 illustrates more about the function of ISGS symbols.

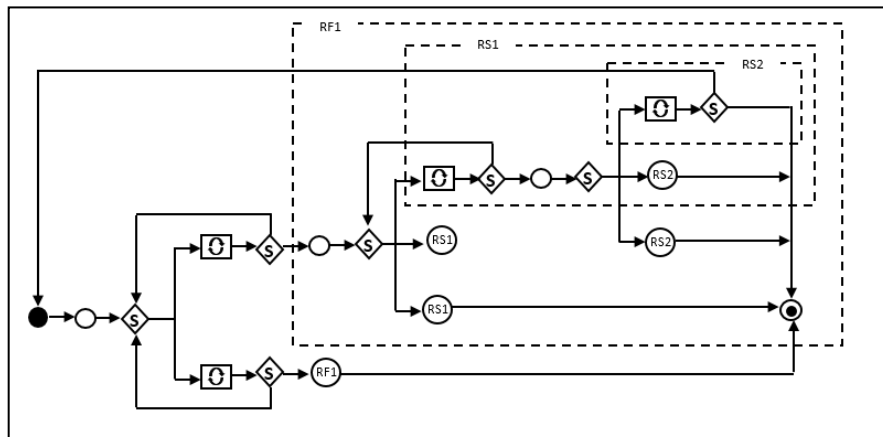


Figure 1. Interactive Story Graph Structure (ISGS).

Table 1. Description of Interactive Story Graph Structure (ISGS) symbols (Narawi et al., 2020)

Symbol	Name	Functions	Total Usage
●	Start	Represents a starting of the story	1
○	Scene	Represents a new scene	≥ 1
◇	Multi-option node	Represents options for users to choose either positive or negative actions	≥ 2
⊞	Interaction node	Story node with interaction part, such as drag, drop and click in the animation	≥ 0
□	Story node	Story node without interaction part in the animation	≥ 1
⊙	Repetition of a single part	Represents a repetition of a single part in one scene	≥ 0
⊙	Repetition of the full part	Represents a repetition of the full part in one scene	≥ 0
⊞	Repetition part	Indicates as a repetition part or area for RS and RF	≥ 0
⊙	End	Represents an ending of the story	1

2.2 Storytelling Prototype

The storytelling prototype was developed using Adobe Animate Creative Cloud software. The illustration shows the use of a case diagram in Figure 2 and the description in Table 2 used as the guideline for the application development.

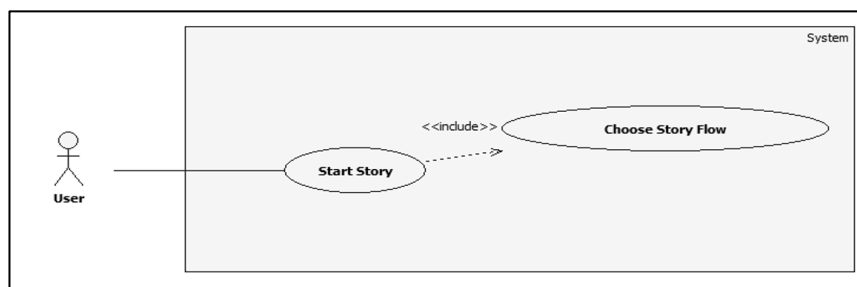


Figure 2. The use of a Case Diagram in the Storytelling Application

Table 2. The use of a Case Description in the Storytelling Application

1a. Id No.	UD 1	1b. Title	UC1-Start Story
2. Actor	1. User		
3. Brief Description	1. The case used allows users to click the button to start the story in the application.		
4. Preconditions	1. Users need to click the start button.		
5. Normal Flow	1. The case used begins when users click the start button. 2. The system will display texts and images. 3. The system will display dialogue boxes. 4. Users click the button to proceed to the next dialogue. 5. The system receives the request to proceed. 6. If users reach a decision point, please refer to Alternate Flow A1. 7. The system receives instruction and will determine the story flow based on the users' options. 8. Before continuing to the next chapter, the system will display a reversion menu. 8.1. Users will be asked whether to continue to the next chapter; please refer to Alternate Flow A2. 9. The system receives instruction after users have made the decision. 10. After proceeding to several decision points, users will reach the ending based on their options. 11. The case used ends.		
6. Extension – Alternate Flow	<u>A1. Decision point</u> A1.1 Leads users to another scene. A1.2 Leads to another scene with the different story flow. A1.3 The case used continues. <u>A2. Reversion menu</u> A2.1 If YES, the system will load the next chapter. A2.2 If NO, the system will lead users back to the previous decision point. A2.3 The case used continues.		

i. The Flow of Storytelling

Figure 3 is the story's flowchart describing the whole storytelling application system from the start until the end. Every decision point and path can be seen, and the reversion feature brought by the ISGS is also implemented in the system.

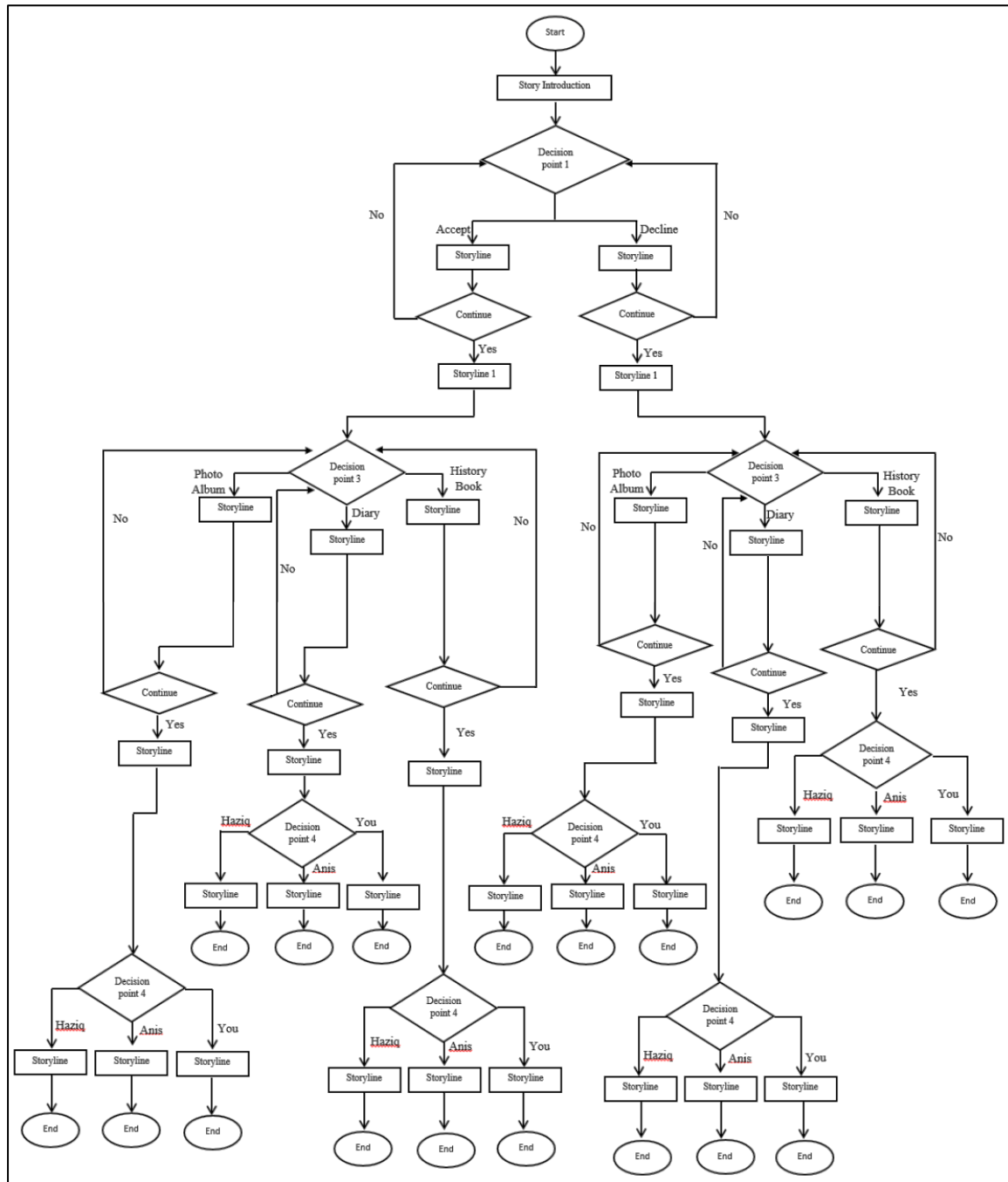


Figure 3. Flowchart of the Storytelling Application

ii. The Interface

The interface residing in the prototype is attractive and user friendly. The prototype shown in Figure 4 and Figure 5 provides graphics and texts to enable users to read and understand the story easily. Some buttons are used to ensure the interaction between users and the prototype; users can choose the options from the decision point.



Figure 4. Screen Shot of the Storytelling Application



Figure 5. Screen Shot of the Storytelling Application

3. Evaluation

The evaluation was conducted with 36 respondents at random to provide their reviews on the storytelling prototype. They have experienced other storytelling applications, and their age was between 17 to 24 years old. The questionnaire was divided into four constructs: expectation, ease of navigation, understanding, and satisfaction. During the data analysis, the questions were translated into a Likert scale; the opinion is expressed in a continuum from strongly disagree to strongly agree (Boone & Boone, 2012).

The expert reviews' responses were exported into data coding using Statistical Package for Social Sciences (SPSS). As the ideal number is the concerned for the number of scales, the data show that seven categories onwards gain less from a psychometric point of view than between four to seven. The research concluded that the minimum categories are four to ensure a reasonable reliability level (Lozano et al., 2008). As stated by Malechwanz (2019), a four-point Likert scale is the optimal number of alternatives. Therefore, the questionnaire used the four-point Likert scale; strongly disagree was represented by 1, disagree by 2, agree by 3, and

strongly agree by 4. There were ten questions to measure the enjoyment sensation of the prototype, as shown in Table 3.

Table 3. Enjoyment Features Represented by a Set of Questions.

Questions	Strongly Disagree	Disagree	Agree	Strongly Agree
A. <u>Expectation</u> A1. The application meets my expectation. A2. The reaction while using the application is wonderful.	1	2	3	4
B. <u>Ease of navigation</u> B1. I find it easy to navigate through the different storyline provided in this application. B2. I enjoy using and navigating the application.	1	2	3	4
C. <u>Understanding</u> C1. I do understand the moral value of the story. C2. Technically, I do understand the ability to revert our decision to discover a different story path.	1	2	3	4
D. <u>Satisfaction</u> D1. I do enjoy the experience of different storyline to reach a different ending. D2. I do feel satisfied after using this application. D3. I will use this application again. D4. I would like to recommend this application to others.	1	2	3	4

3.1 Findings and Discussion

All data gathered were presented in terms of the frequency, mean, and standard deviation. In this section, the evaluation was constructed to identify the enjoyment of using the storytelling prototype. The questionnaire consisted of four parts of the enjoyment sensation: expectation, ease of navigation, understanding, and satisfaction. The expectation part was to define the anticipation and reaction from users when using the storytelling prototype. The second part was to identify the easiness and enjoyment of having different storylines in the storytelling prototype that might differ from the usual storytelling, especially in terms of the ease of navigation. Meanwhile, the third part was defining the users' understanding of the content moral value and revert decisions in the storytelling prototype. The final part was to define the overall satisfaction and enjoyment of using the storytelling prototype.

The evaluators consisted of 36 respondents chosen based on their experience using other storytelling applications. Thus, their review is useful and relevant as they are knowledgeable about storytelling applications. It is essential to evaluate if the evaluators know and experience a specific part of the storytelling application to generate accurate results. The questionnaire consisted of ten statements in total. The first part to the third part of the questionnaire consisted of two statements for each part, in which to define the expectation, ease of navigation, and understanding of the storytelling prototype, respectively. The fourth part was to define satisfaction, consisting of four statements.

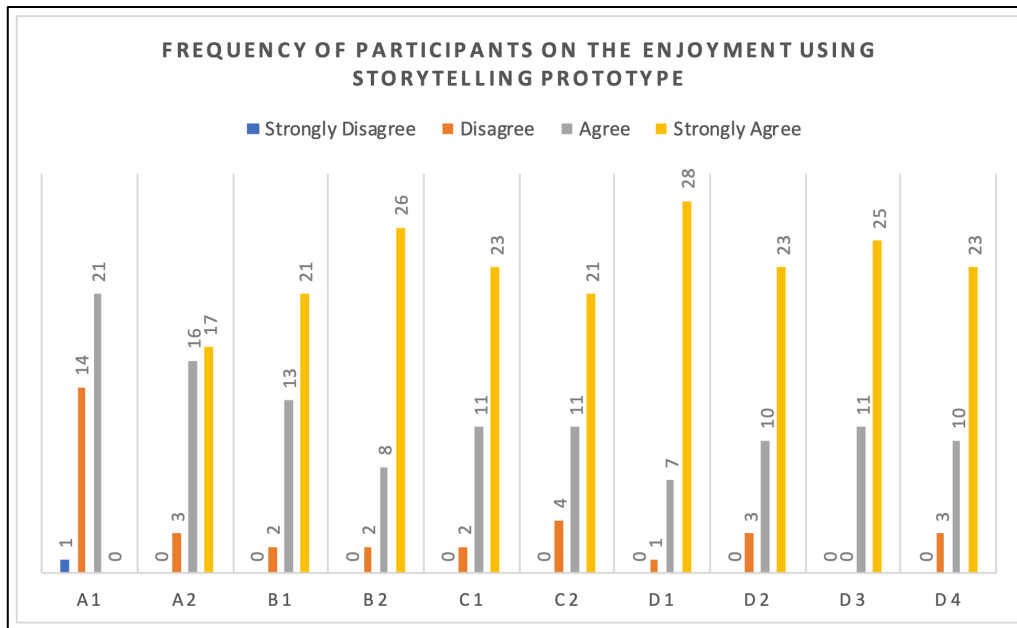


Figure 6. Bar Chart of Respondents Enjoying using the Prototype.

As shown in Figure 6, the result is presented in the bar chart representing the respondents' frequency using the storytelling prototype based on four parts of the enjoyment sensation. The A1 and A2 statements define the respondents' expectation in using the storytelling prototype. For A1 question, only one respondent strongly disagrees, and 14 respondents disagree that the storytelling prototype met their expectation while 21 respondents agree that the storytelling prototype met their expectation. For A2 question, only three respondents disagree that they had a wonderful reaction when using the storytelling prototype, but 16 and 17 respondents agree and strongly agree to have a wonderful reaction while using the storytelling prototype.

The second part of the questionnaire defined the ease of navigation using B1 and B2 statements. Only two respondents disagree with both statements indicating that the storytelling prototype is not easy to navigate through the different storyline, and they do not enjoy using it. While 13 and 21 respondents agree and strongly agree concerning the easiness to navigate through different storyline provided in the storytelling prototype, as stated in B1 statement. Moreover, 8 and 26 respondents agree and strongly agree, respectively, with the B2 statement that they enjoyed using and navigating the storytelling prototype.

The C1 and C2 statements defined the understanding of using the storytelling prototype. Two respondents disagree with C1 statement indicating that they found it is hard to understand the moral value in the storytelling, but 11 respondents agree, and 23 respondents strongly agree that they understood the moral value. For C2 statement, two respondents disagree that they understood the ability to revert decisions to a different story path. However, 11 and 21 respondents agree and strongly disagree that they understood the ability to revert decisions in the storytelling prototype.

The final part of the questionnaire defined satisfaction using D1 to D4 statements. D1 stated the enjoyment of having a different storyline to reach a different ending. Based on Figure 6, only one respondent disagrees while 7 and 28 respondents agree and strongly agree, respectively, with D1 statement. Furthermore, for D2 statement, only three respondents disagree with the satisfaction of using the storytelling prototype. However, 10 and 23 respondents agree and strongly agree that they felt satisfied when using the storytelling prototype. D3 statement indicated the respondents' willingness to use the storytelling prototype

again. 11 and 25 respondents agree and strongly agree, respectively, that they will use the storytelling prototype again. The final D4 statement defined the respondents' willingness to recommend the storytelling prototype to others. Only three respondents disagree to recommend to others, but 10 and 23 respondents agree and strongly agree to recommend to other people.

The frequency of respondents enjoying using the storytelling prototype in Figure 6 is also presented in a table. Table 4 shows the mean, standard deviation, generally disagree and generally agree. Generally, disagree indicates the total respondents who disagree and strongly disagree while generally agree indicates the total respondents who agree and strongly agree. The values for generally disagree and generally agree are retrieved from the bar chart in Figure 6, and the total for both categories are calculated in percentage.

Table 4. Evaluation's result of the enjoyment in using the storytelling prototype.

	Mean	Std. Deviation	Generally disagree	Generally agree
A1	2.56	0.558	15	21
A2	3.39	0.645	3	33
Total (%)			25	75
B1	3.53	0.609	2	34
B2	3.67	0.586	2	34
Total (%)			5.6	94.4
C1	3.58	0.604	2	34
C2	3.47	0.696	4	32
Total (%)			8.3	91.7
D1	3.75	0.500	1	35
D2	3.56	0.652	3	33
D3	3.69	0.467	0	36
D4	3.56	0.652	3	33
Total (%)			4.9	95.1
Total all parts (%)			9.72	90.28
Note: Generally disagree = Strongly disagree + disagree, Generally agree = Strongly agree + agree				

Descriptive descriptions are used to convey quantitative descriptions in controlled forms (Sharma, 2019). It helps to simplify the data. The table summarises that mostly the respondents agree and strongly agree with statements from A2 to D4 to determine the four parts of the enjoyment sensation. The statements reach a mean value of ≥ 3.00 except A1, which only obtain 2.56. A1 statement also has the most respondents who generally disagree, with 15 out of 36 respondents indicate that the storytelling prototype did not meet their expectations. Overall, 90.28% generally agree and strongly agree with the four parts of the storytelling prototype's enjoyment sensation.

3.2 Reliability and Validity

Reliability and validity are critical elements to produce quality and reliable research (Sari et al., 2017). In conducting the research, the Cronbach's alpha test was used in measuring the internal consistency reliability.

Table 5. Reliability Analysis Result - Summary Statistics

	Cronbach's Alpha	Cronbach's Alpha Based on Standardised Items	No of Items
Q(A1 – D4)	0.871	0.870	10

Cronbach's alpha reliability describes reliability or internal consistency. It tests to define if the questionnaire is reliable. Cronbach's alpha value is computed with the alpha value

of $\alpha > .7$, which is considered reliable (Keith, 2018). As shown in Table 5, the α value is 0.871, which is more than .7. Thus, it proves that the measurement of data obtained is acceptable.

Table 6. Validity Analysis Result - Summary Statistics

Q(A1 – D4)	KMO Test	Bartlett’s Test (sig)
	0.809	≤0.001

The validity was tested to define what and how well the test measures a characteristic (Mohajan, 2017); the result is shown in Table 6. The KMO test result is 0.809, achieving the value of $\geq .7$. It concludes that the study results are defined as trusted, consistent, and accurate as the reliability and validity have reached the approved value.

Table 7. Component Loadings for the Rotating Components – Summary Statistics

	Component Loading			Communalities
	1	2	3	
A1	0.233	0.753	0.102	0.632
A2	0.542	0.585	0.307	0.731
B1	0.658	-0.028	0.176	0.465
B2	0.896	0.309	0.124	0.913
C1	0.779	0.245	0.182	0.700
C2	0.688	0.192	-0.381	0.655
D1	0.885	0.206	0.018	0.826
D2	0.669	0.556	-0.264	0.826
D3	0.125	0.061	0.909	0.846
D4	0.045	0.886	-0.069	0.792
Eigenvalues	3.91	2.24	1.23	
% of Variance	39.12	22.43	12.31	

Table 7 shows the questions of A1 to D4 consisted of 10 items that were loaded onto three factors with an eigenvalue of 3.91, 2.24 and 1.23 that must ≥ 1.000 was explained 39.12 percent, 22.43 percent, and 12.31 percent of total variation. All factor loadings exceeded 0.4 were considered.

4. Conclusion

Findings show that 90.28% of respondents enjoyed using the storytelling prototype, representing their experiences with the story. They can decide to have their story ending based on their options. In details, the results for each enjoyment part were calculated using the total number of the generally agreed respondents. It comprised 75% of good expectation, 94.4% of the ease of navigation, 91.7% of well understanding of the storytelling flow, and 95.1% of satisfaction. They were satisfied with the reversion function in which they can undo their decision made in the story. The ISGS structure helps create a storyline flow before they can generate it using a digital storytelling application. The structure allows users to revert the option of the decision made earlier in which users have the freedom of control over the story flow. Moreover, the multiple ending depending on users’ decisions creates satisfaction for the interactive storytelling application. Users can experience different story path until the ending without limits.

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