Multimedia Elements of Digital Storytelling for Dyslexic Children

Norzehan Sakamat[1], Siti Nabilah Sabri[2] and Norizan Mat Diah[2]

[1]Pusat Asasi, Universiti Teknologi MARA,
Kampus Dengkil, 43800 Dengkil, Selangor Darul Ehsan, Malaysia
[2]Faculty of Computing and Mathematical Science,
Universiti Teknologi MARA, 40450, Shah Alam, Selangor Darul Ehsan, Malaysia
E-mail: norzehan012@salam.uitm.edu.my, Sitinabilahsabri@gmail.com,
norizan@tmsk.uitm.edu.my

Received: 7 February 2017
Accepted: 9 October 2017

ABSTRACT

Storytelling is considered as an interactive social arts that uses word and gestures to reveal the elements and images of a story while engaging the listener's imagination. Multimedia based digital storytelling learning approach provides interesting, interactive, engaging and multisensory learning experience to children. Children explore new experience and scenarios as new stories are being told. This study concentrates on determining the best combination of elements for designing effective digital storytelling applications specifically for the usage of dyslexic children. Dyslexic children are known to have a common learning difficulty that can cause problems with reading, writing, spelling and comprehension. These applications are design with the objective to help in improving dyslexic children ability in readings and comprehensions. Four elements were derived from extensive literature studies. The elements are multimedia components, multi-sensory instructional approach, emotional design and games design. The relationship among all the elements were determine and described in details as it will be used to contribute to the design and development of the application in further works. The strength of this study is it models the combinations of technology, psychology and instructional approach as a support components for developing an effective digital story telling learning application for dyslexic children.

Keywords: *storytelling, multimedia, multisensory, dyslexic children*

INTRODUCTION

Dyslexia is defined as a specific learning disability that is neurological in origin. It is characterised by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instructions [1]. Dyslexic individuals are also said to have problems in reading comprehension, poor short term memory and reduced reading experience that can impede the growth of vocabulary and background knowledge [2]. In order to help dyslexic children in overcoming their problems, several digital applications have been developed. One of the suggested applications is storytelling application [3].

Storytelling is a methodology which exploits narration to give meaning and sense to reality. Historically, storytelling which is the oldest method of education, has been used to impart knowledge, wisdom, and values and to promote literacy development. It is the interactive art of using words and actions to reveal the elements and images of a story while encouraging the listener's imagination. Storytelling consist of the followings components [4-5]:

(i) Interactive;
(ii) Comprise of words;
(iii) Uses vocalisation and gestures (physical movement);
(iv) It presents a story; and
(v) Inspires the active imagination of the audience.

Storytelling should have all the components blended together and these components can be attuned by the storyteller to cater for the knowledge and age level of the listeners. Listeners explore new worlds and scenarios as new stories are being told. This become clear that these experience is an added advantage to their critical thinking skills which will also change their way of onceptualising, applying, analysing, synthesising, and/or evaluating information [4].

Based on the traditional storytelling component, it was found that multimedia approach is the most suitable to be used to implement storytelling digitally. Multimedia approach which supports interactivity, combination of text, audio, video and animations; enable the presentation of story, vocalisation and gestures that can spark the mind to be more creative or resourceful. Digital storytelling is generally defined as a 'modern expression of the ancient art of storytelling' [6]. While there is not a single definite digital storytelling meaning, the majority emphasises digital storytelling as the mixture of multimedia implementation which includes graphics, audio, video and animation to tell a story to audience [7]. It has been used in education areas to enhance readings, comprehensions and learning capabilities among children. By integration of technology, storytelling has also taken a new structure by giving more impact in communicating ideas and sharing knowledge [3][8]. Multimedia usage are believed to be capable to support dyslexic learners [9-10]. They are found more motivated with the use of multimedia courseware [11]. Learning materials, containing text, can be supplemented with representation in graphical and auditory forms. Having learning materials in this way, dyslexic students were able to grasp meaning from what is being spoken about a picture. Thus, can reduce the difficulties dyslexic students have in recognising or confusing between letters or familiar words.

This research focuses on finding effective combinations of elements for designing a digital storytelling application specifically for dyslexic children. In order to find the elements, it is important to look at the development of the digital storytelling storyline. Developing a storyline is important for designing and constructing a story from the beginning to the end for digital storytelling applications. Storyline could determine the types of elements needed in the storytelling application. A thorough literature studies has been done to achieve this objective. The list below shows the main findings that were collected:

- An interesting and engaging storytelling should incorporate strong emotional elements [12-13];
- Continuation and repetitive practice should be allowed in order to overcome short term memory issue in dyslexic children [14-15];
- Storyline should be noticed by participating motion graphic or interactive multimedia [16];

- Audio and video should be used to support understanding and encourage engagement [17];
- Words and pictures as well as auditory and narration without corresponding on-screen text are also suggested [18];
- Most authorities considered that the key features of effective learning and teaching for children and young people with dyslexia should be multi-sensory, well-structured and interactive and that they should raise self-esteem and be relevant and meaningful [19]. Multisensory approach learning cover all senses; visual, auditory, kinetic, and tactile elements will ease students who struggle to read to retain the required information [20-21];
- Children diagnosed with a learning disability rarely get invited into conversations allow them to express themselves freely. The narrative approach will give the children the feeling of freedom to 'speak' on any desired issue. This help the children to be more confident, skillful and knowledgeable, thus inculcate the abilities to appropriately manage their problems in life [22-24]; and
- A fun element injected to computer or digital devices could attract dyslexic children's attention [25]. Researchers have found that computer games can capture dyslexic children attention and improve their readings and comprehension skills [26].

METHODOLOGY AND DESIGN OF MULTIMEDIA DIGITAL STORYTELLING FOR DYSLEXIC CHILDREN

This Section discusses the elements that have been derived from the literature review that has been discussed in the preceding section. The relations of each element are also discussed in the design part.

Elements for Multimedia Digital Storytelling

A comprehensive literature review was conducted to help determining the multimedia elements for the storytelling application. The findings from the literature review were group according to four main groups. The four vital components that were identified for designing an effective multimedia elements of digital storytelling for dyslexic children are multimedia small components, multi-sensory instructional approach, emotional design element and games elements (Figure 1).

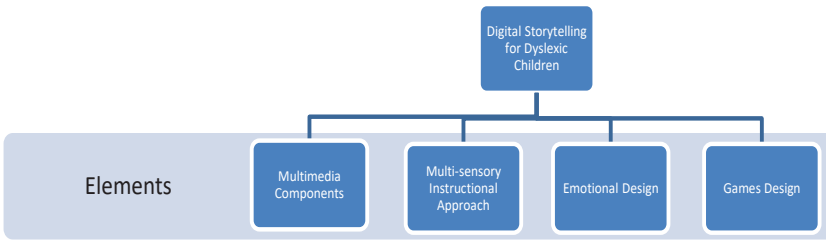

Figure 1: Identified Elements in Digital Storytelling

The reason why those elements were selected is elaborated below. Blending all the identified elements are expected to make the application more attractive and effective for dyslexic children. The elements are explained as follows:

(i) Multimedia Components

Multimedia components include text, pictures, animation, audio (voice over, narration, sound effect, sound background or music), video performance or short movie and interactive functions (include colour setting, interface or graphic). Research proved that the words/text and pictures or video presented simultaneously are more effective than when they are presented separately [27-28]. Animation appears to be most effective when information, concepts, process or information that cannot be visualised easily [29]. While narration and video are much more effective than combination of narration, video and text [30]. Narration and text rely on the same channel in the brain to process information [31].

(ii) Multi-sensory Instructional Approach

Multisensory learning can be particularly helpful for kids with learning and attention issues like dyslexic children. Multi-sensory instructional approach is one important aspect of instruction for dyslexic students that is used by clinically trained teachers. Effective instruction for students with dyslexia should be unambiguous, straight forward, cumulative, intensive, and dedicated on the structure of language. Using multiple senses gives them ways to connect with what they're learning. Multi-sensory approach to teaching-learning also aims towards making the learning as individualised and self-dependent as possible. The individual learner will be able to proceed on his learning path with their own pace according to their own needs.

(iii) Emotional Design Elements

Emotions are defined as a complex experience of consciousness, bodily sensation, and behavior that reflects the personal significance of a thing, an event, or a state of affairs. Applying emotional design principles in multimedia lessons increased the learner's motivation to initiate, energise, and maintain goal, which is hope that it will lead to improve learning results [32-34]. Considering emotional element designs are vital because user will first interact with the interface of the application [35]. Three emotions are identified as crucial for emotion development. The three emotions are positive, neutral and negative emotions [36-37]. To integrate technological application with emotion, designers are recommended to conduct preliminary study on the students attachment to the product physically, emotionally and cognitively [38].

iv) Game Elements

Game elements when applied to learning will make learning more engaging and motivating. Children including dyslexic children are fascinated with games. The word games will trigger the idea of having fun in children mind. By using game elements, children will have fun playing games without knowing that they are actually learning. Learning applications that injected game elements should consist of eight criteria [39]. The eight criteria are:

- Mystery - Mystery arouses curiosity within the learner, and can motivate the learner to fill in gaps and locate discrepancies in information;
- Action - Action and interactivity engages learners;
- Challenge - Humans enjoy overcoming challenges. Start learning with a challenge: Something that is difficult, that requires deep thinking, and that cannot be achieved by guessing;
- Being at risk - The learner has something to risk when taking an action or making a decision such as a player could lose a life, be required to start over, or lose all the gold coins collected because of a wrong move;
- Uncertainty of outcome - Closely related to risk is putting the learner in a situation in which they can't predict the outcome;
- Opportunity for mastery - People like to have a sense of mastery. They like to know that they know the content. Give the learner a series of difficult problems, once they solve one problem, give them a visible reward like a badge and have them move on to the next difficult problem increasing the difficulty level until the final problem;
- Visible signs of progress - Provide progress bars, levels, and coins to collect—all items indicating the player is closer to the end goal; and
- Emotional content - Games embrace humans' emotions such as frustration, excitement, unhappiness, anger and joy. Putting elements of emotion in learning would be very beneficial since humans would learn better when the learning is tied to strong emotions.

Relationship Model Design

In this section, the design of relationship models between elements are illustrated (Figure 2) and explained. These designs integrate the elements that were discussed in the previous section. The relationships among the elements are carefully designed in order to fully utilise each integrated elements to produce an effective digital story storytelling application for dyslexic children.

Figure 2 illustrates the model that shows the relationship between the four elements.

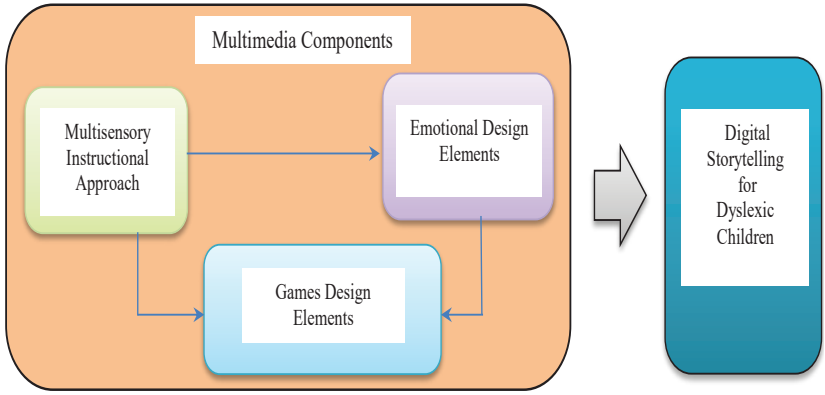

Figure 2: Relationship Model of the Elements (source by author)

Multimedia components play an important role in this model. Multisensory instructional approach, emotional design elements and game elements all depends on multimedia components to enhance their capabilities. The use of multimedia in multisensory instructional approach is vital to make digital storytelling learning interesting, lively and effective. The combination of variety of media component will assist learning using all senses (sight, sound, movement and touchs) to aid kids connect language to words. Emotional design strongly relates to multimedia interface elements such as colours, graphics and text. These elements elicit emotions and therefore stimulate the brain for cognitive activity which will determine whether the student will be attracted, persuaded and motivated to learning. Multimedia components contribute to game design an appealing interface colours, catchy audio, fascinating videos and reality based looking animation. However, games criteria such as mystery, action and challenge needs multisensory instructional approach and emotional design elements to make it engaging and motivational.

CONCLUSION

Previous literatures has proven that multimedia has many successful stories when relates to dyslexic learning in the digital environment. This study intends to discover the best elements for creating an effective application Digital Storytelling for Dyslexic Children. The relationship design that determine the relations of each element are illustrated and described in detail. Based on extensive literature studies, four elements are discovered. The four elements are multimedia components, multi-sensory instructional approach, emotional design and games design. All these elements are incorporated together and the relationship among the elements were also determined. The relationship model are derived, illustrated and explained in details to rectify the needs of each element in producing an effective design of digital storytelling for dyslexic children. It will be referred to as the main blueprint in the next implementation phase. Further studies should also be conducted to determine the emotional design details, to identify the suitable software and hardware for the application developments and on finding the best method to test the applications.

Integrating multimedia component with multisensory instructional approach, emotional design elements and game elements should be able to effectively facilitate dyslexic students in demonstrating mastery of the learning objective. The integrated elements are also expected to cater for various student's interest, ability, learning style and to support individual learning among the children. It is hope that it will tap the children into their learning strengths of making connections and forming long term memories. It is also expected that this design can cater for kids with different learning styles, meeting the varying needs of dyslexic students and gives the students a chance to succeed in academic.

REFERENCES

[1] International Dyslexia Association, 2016. Definition of Dyslexia. Retrieve from https://dyslexiaida.org/definition-of-dyslexia/

[2] M. J. Snowling, 2001. From Language to Reading and Dyslexia. *Dyslexia*, *7*(1), pp. 37-46. DOI: 10.1002/dys.185.

[3] R. Benmayor, 2008. Digital Storytelling as a Signature Pedagogy for the New Humanities. *Arts Humanities Higher Education*, *7*(2), pp. 188–204. DOI: 10.1177/1474022208088648.

[4] The National Storytelling Network (http://www.storynet.org/)

[5] K. L. Hsiao, H. P. Lu & W. C. Lan, 2013. The Influence of the Components of Storytelling Blogs on Readers' Travel Intentions. *Internet Research*, *23*(2), pp. 160-182. DOI: 10.1108/10662241311313303.

[6] Digital Storytelling for Communities, 2015. Digital Story Telling Defined, retrieved from https://librarydigitalstorytelling.wordpress.com/what/.

[7] N. Smeda, E. Dakich, & N. Sharda, 2014. The Effectiveness of Digital Storytelling in the Classrooms: A Comprehensive Study. *Smart Learning Environments, 1*(1), pp. 6. DOI: 10.1186/s40561-014-0006-3.

[8] Harun, Harryizman and Shiratuddin, Norshuhada, 2009. Digital Storytelling: New Medium in Communicating Knowledge and Information. *International Conference on Innovation in Teaching and Management of Higher Education* (ICITM 09), Shah Alam, Selangor, Malaysia, 21-23 December, 2009.

[9] Nigel, Beacham, n.d..The Potential of Multimedia to Enhance Learning for Students With Dyslexia. Skills for Access. http://skillsforaccess.org.uk/articles.php?id=150 (access March 19, 2010).

[10] Abdul Rahman, Fadilahwati, Mokhtar, Fattawi Nor Aziah & S. Ronaldi, 2012. Multimedia Elements as Instruction for Dyslexic Children. *International Journal of Education and Information Technologies, 6*(2) ,pp. 193-200.

[11] Nor Hasbiah, 2007. Perisian Kursus Multimedia dalam Literasi Matematik (D- Matematika) Untuk Pelajar Disleksia. Unpublished PhD's Thesis. Universiti Kebangsaan Malaysia, Bangi.

[12] J., Rambli, D. R., & S. Sulaiman, 2011. G-Flash: An Authoring Tool for Guided Digital Storytelling. 2*011 IEEE Symposium on Computers & Informatics*. Kuala Lumpur, 20-23 March, 2011. DOI: 10.1109/ISCI.2011.5958948.

[13] C. Dong, 2010. Interface Design, Positive Emotions and Multimedia Learning. In H. Song & T. Kidd: Handbook of Research on Human Performance and Instructional Technology, 182. DOI:10.4018/978-1-60566-782-9.ch011.

[14] J. Haladjian, D. Richter, D. Ismailović, P. Muntean, & B. Bruegge, 2013. A Framework for the Creation of Mobile Educational Games for Dyslexic Children. In *International Conference on Mobile Learning* (ML), pp. 148-151

[15] J. F. Démonet, M. J. Taylor, & Y. Chaix, 2004. Developmental Dyslexia. *The Lancet*, *363*(9419), pp. 1451-1460. DOI:10.1016/S0140-6736(04)16106-0.

[16] G. Reid, 2005. Dyslexia and Inclusion: Classroom Approaches for Assessment, Teaching and Learning. London: David Fulton Publishers.

[17] S. K. Chung, 2007. Art Education Technology: Digital Storytelling. *Journal Art Education, 60*(2), pp. 17-22.

[18] N. A. Beacham, & J. L. Alty, 2006. An Investigation Into the Effects That Digital Media Can Have on the Learning Outcomes of Individuals Who Have Dyslexia. *Computers & Education, 47*(1), pp. 74-93. DOI:10.1016/j.compedu.2004.10.006.

[19] U. Frith, & M. Snowling, 1983. Reading for Meaning and Reading for Sound in Autistic and Dyslexic Children. *British Journal of Developmental Psychology, 1*(4), pp. 329-342. DOI: 10.1111/2044-835x.1983.tb00906.

[20] G.Reid, 2003. *Dyslexia: A Practitioner's Handbook*. New Jersey Wiley Blackwell.

[21] V. Subramaniam, V. K. Mallan, & Noor Hayati Che Mat, 2013. Multi-Senses Explication Activities Module for Dyslexic Children in Malaysia. *Asian Social Science ASS, 9*(7), pp. 241-266. DOI:10.5539/ass.v9n7p241.

[22] P. Rahmani, 2011. The Efficacy of Narrative Therapy and Storytelling in Reducing Reading Errors of Dyslexic Children. *Procedia - Social and Behavioral Sciences*, *29*, pp. 780-785. DOI:10.1016/j.sbspro.2011.11.305.

[23] A. Morgan, 2000. *What is Narrative Therapy*. Adelaide: Dulwich Centre Publications.

[24] J. C. Freeman, D. Epston, & D. Lobovits, 1997. P*layful Approaches to Serious Problems: Narrative Therapy with Children and Their Families*. New York: WW Norton & Company.

[25] M. M. Merzenich, W. M. Jenkins, P. Johnston, C. Schreiner, S. L. Miller & P. Tallal, 1996. Temporal Processing Deficits of Language-learning Impaired Children Ameliorated by Training. *Science-AAAS-Weekly Paper Edition, 271*(5245), pp. 77-80.

[26] H. Lyytinen, M. Ronimus, A. Alanko, A. –M. Poikkeus & M. Taanila, 2007. Early Identification of Dyslexia and the use of Computer Game-Based Practice to Support Reading Acquisition. *Nordic Psychology, 59*(2), pp. 109-126.

[27] R. E. Mayer, & V. K. Sims, 1994. For Whom is a Picture Worth a Thousand Words? Extensions of a Dual-Coding Theory of Multimedia Learning. *Journal of Educational Psychology, 86*(3), pp. 389. DOI: 10.1037/0022-0663.86.3.389.

[28] D. M. Chun & J. L. Plass, 1997. Research on Text Comprehension in Multimedia Environments.

[29] P. Ayres & F. Paas, 2007. Can the Cognitive Load Approach Make Instructional Animations More Effective?. *Applied Cognitive Psychology, 21*(6), pp. 811-820. DOI:10.1002/acp.1351.

[30] R. E. Mayer (Ed.), 2005. T*he Cambridge Handbook of Multimedia Learning*. Cambridge: Cambridge University Press.

[31] A. D. Baddelley, 1999. *Essentials of Human Memory*. United Kingdom: Phychology Press.

[32] R. Pekrun, 2000. A Social-cognitive, Control-value Theory of Achievement Emotions. In J. Heckhausen (Ed.), Motivational Psychology of Human Development: Developing Motivation and Motivating Development, pp. 143-163. New York, NY, US: Elsevier Science. http://dx.doi.org/10.1016/S0166-4115(00) 80010-2.

[33] R. Pekrun, 2005. Progress and Open Problems in Educational Emotion Research. *Learning and Instruction, 15*(5), pp. 497-506. http://dx.doi.org/10.1016/j.learninstruc.2005.07.014.

[34] E. Um, J. L. Plass, E. O. Hayward & B. D. Homer, 2011. Emotional Design in Multimedia Learning. *Journal of Educational Psychology, 104*(2), pp. 485-498. http:// dx.doi.org/10.1037/a0026609.

[35] J. L. Plass, S. Heidig, E. O. Hayward, B. D. Homer & E. Um, 2014. Emotional Design in Multimedia Learning: Effects of Shape and Color on Affect and Learning. *Learning and Instruction*, *29*, pp. 128-140. DOI:10.106/j.learninstruc.2013.02.006.

[36] R. E. Mayer, & G. Estrella, 2014. Benefits of Emotional Design in Multimedia Instruction. *Learning and Instruction*, 33, pp. 12-18. DOI:10.106/j.learninstruc.2014.02.004.

[37] J. A. Kumar, B. Muniandy, & W. Y. Wan Ahmad Jaafar, 2014, November. The Emotional Effect of Multimedia Induced Emotions on E-learning Among Polytechnic Students. In *International Conference on Emerging Trends in Academic Research*, pp. 47-57.

[38] E. Knutz, & T. Markussen, 2010. Measuring and Communicating Emotions Through Game Design. In *Proceedings of the 7th International Conference on Design & Emotion, Illinois Institute of Technology, Chicago.*

[39] K. M. Kapp, 2012. *The Gamification of Learning and Instruction*. San Francisco: John Willey & Sons. Inc.