Exploring Digital Comics as an Edutainment Tool: An Overview

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ABSTRACT

This paperaims toexplore the growing potential of digital comics and graphic novels as an edutainment tool. Initially, the evolvement of comics medium along with academic and commercial initiatives in designing comicware systems arebriefly discussed. Prominent to this study, the methods and impact of utilizing this visual media with embedded instructional content and student-generated comics in classroom setting are rationallyoutlined. By recognizing the emerging technologies available for supporting and accelerating educational comic development, this article addresses the diverse research challenges and opportunities of innovating effective strategies to enhance comics integrated learning across disciplines.

Keywords:comics, comicware, authoring tools, edutainment, educational comics, storytelling, personalization.

I INTRODUCTION

Edutainment is part of children's everyday life as learners. Students who are involved in blended-learning environment have shown expansion in their analytical skills (Kalthom, Aida, Norasiken, Faaizah, Norshahidatul, &Hazmilah, 2011). Partially belong to edutainment media, the shift towards digital comics utilization to support activities in education has created new collaboration opportunities and potentials for cross-disciplinary community research.

This paper discusses few important issues related to comics for learning. The first section explains the origin of comics which now have upgraded into state-of-the-art technological form. Next, comic reading applications for desktop and mobile users are elucidated. The literature continues with classification of comic development tools according to user requirements. Lastly, comic usage in education is clarified basedon content assimilation and authoring activity.

II THE EVOLUTION OF COMICS

Although comics coexist in variety of format, they are traditionallycreated in printed medium.Digital comics and interactive comic begin to transpirewhenaccess to computer technology is globallysupported.

A. Printed Comics

Comic (or sequential art) is defined as chronological images that provide narrative to their audience. Prior influential writings(Eisner, 1985; McCloud, 1993) have defined comics in complex terms of language, communication and visual medium. In spite of the theoretical debate, the succession of pictorial concept has been existed for millenniums where it is carved or painted as tapestries and hieroglyphswhich work as an early system to symbolize and record information(Perry & Aldridge, 1971).

Only in the 20th Centuries, comic strips have been published as editorial cartoon in printed form (Sabin, 2001). Served for entertainment and political purposes, comics are distributed either daily or weekly newspaper. Subsequently, comicshave expended into variety of format ranging from gags, comic books, digests to graphics novels(Perry & Aldridge, 1971,Sabin, 2001).

Predominantly, the presentation of narrative in comics follows a general set of visual conventionsas shown in Figure 1. First, events are structurally arranged in framed panels or containing imagery of illustrated scenes. Dialogue is shown in balloon or speech bubble with a tail pointing to the character, embedding readable text. Besides that, text caption represents story narration whether from third or first person (Eisner, 1985).

On the other hand, these rules only attend as basis in cartooning and comic design. Generally, artists have various imaginative methods in manipulating comics' component including onomatopoeia text and special effect lines to convey dissimilar emotional impact to their readers(McCloud, 2000).

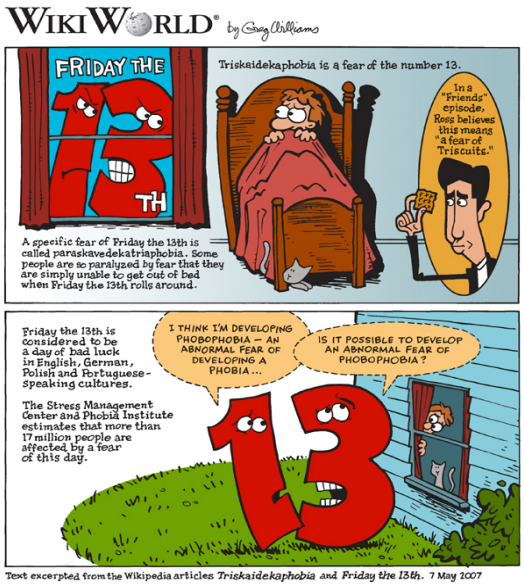

Figure 1 Comic Strip with basic Panel, Speech Balloonand Text Caption Elements (Source:Wikimedia Commons).

B. Digital Comics

The arrival of digital technology has particularly resolved hassles to maintain the quality of comic papers due to time progression. With portable gadgets, the requirement for large physical spaces such as shelves and boxes to store comic books is no longer an issue. Hundreds of comic files and pages can be digitally shared and downloaded in premium websites with less price compared to printed comics. Since electronic devices derive with built-in reading lights, comic fans have all the time and location flexibility to read comics digitally.

Hence, efforts are madefocusing on understanding comic reading experience among digital era users.Cohn (2013)'s study describes that visual narrative structure relatively reflects comic page layout reading style.Looking at separation, overlap, staggering, insets, and entry-point panel features, the relationship between hierarchic constituent structuresof navigation through page layout and comic reading strategy is formulated (Cohn, 2013).

Additionally with the advantages of digital environment, Horton (2008) has clarified how webcomics (sequential arts posted online) are rapidly composed by amateur comic creators and professionals using Adobe Photoshop, Gimp,and various graphic editing tools. Finally, these comic devotees have plenty of choices to publish their work in public comic hosting sites such as Comic Genesis, The Duck Comics, Smackjeeves, blogs and social media(Lamerichs, 2013; Mitkus, T. 2013).

C. Interactive Comics

As modern technology continue to support the construction and distribution of comics, major interactive features allow spectacular reading experience to users. Opposed to passive digital comics with static visuals, interactive comics incorporate rich multimedia elements consist of video, audio, animation (Steinke, 2004), as well as accepting mouse click, drag, text, and touch input (Lai, Bjornerud, Akahori, & Hayashi, 2002 ; Rall, 2013).

Hypercomics have expanded the feature of interactive comic with non-linear story structure(Meskin, 2007). Different story event is triggered according to the user's interaction with the webcomic respectively.This is demonstrated bythe spatial expansion and trail concept in *infinite canvas* where panels are connected in lines to branch through interactive narrative(McCloud, 2000).As a further remark, Andrews, Baber,Efremov, and Komarov (2012) havedesigned an evolutionary system of interacting with non-linear story in comics that includes competitive and collaborative multiple user narrative construction supported by multi-touch surface table and scenario software.

Thus, interactive comic has given exciting and revolutionized approach for comic enthusiasts and publishers to deliver their masterpieces.

III COMIC VIEWERS

Comic viewer (also known as comic reader) is a dedicated application to display sequential images of and digital comic strips and pages.

A. Desktop Based

Although existing PDF readers enable users to read multiple types of digital documents including comics, ongoing researchis carried out to investigate operative mechanism for explicit viewing and navigating graphic novels. While previous works (Arai & Tolle, 2011; Oie, Higuchi, Kawasaki, Koike, & Murakami, 2011) havecovered on the frames, speech bubble and text segmentation of comic digitization for content indexing, Rigaud, Tsopze, Burie, and Ogier(2013)have improved the methodby extracting texts outside the speech balloon with quicker speed.

Observingendeavors in universal access to computers, a feasible system for disabled users to read graphic novels is demonstrated throughPonsard and Fries (2009)'s experiment. Their prototype'scapabilityto detectframe borders,permitscomicto be displayedin zoom position according to the panel order eased by voice command in an accessible browser.

B. Mobile Based

Primarily, the main challenge of mobile comic executionis concerning on the distinctive presentation of graphic novels ininconsistentinterface size. Multiple techniques have verified how to efficiently extract panels from existing digital comic into mobile sized screens(Tolle & Arai 2013; Tsai et. al, 2013).Moreover, by adopting tapestry, *infinite canvas*

and finger-point theories, Wandani, Wee, and Moses (2011) havetestifiedthe balance between image qualityand comic navigation in mobile devices.

Therefore, profound image processing algorithm and interface design scheme for comic viewers play crucial factors to compromisedecent graphic novel reading experience in desktop and mobile environment.

IV COMIC DEVELOPMENT TOOLS

While general graphic editing tools are used for wide-rangingraster and vector image manipulations,the prompting demand for practicalgraphic novelauthoringsolution by aspiring artists, hobbyists, and professional illustrators has induced the growingamount of digital comic development tools.

A. Original Artwork Based

The workflow of comic design usually begins with scanned line artsor pencil work which are transferred into interactive tool for further refinement (Krikke, 2006).In *Manga Studio*, drawing tablet users have the option to manually illustrate the comic in the mentioned program digitally. Then, colors, word balloons, screen tones,and special effects are positioned using drag-and-drop tools and floating palettes.Besides hand-drawn works, some artistsincorporate 3D rendered art consists of character and background. Transforming this labor-intensive procedure, Wong, Igarashi, Xu, and Shi(2013) have displayed groundbreaking computational comic techniquesfor screening, colorization, and stereoscopic appearance.They added that practitionerswill still have full control towards their artwork manipulation despite the automatic effect generatedby the algorithm.

B. Photo Based

The rise of Digital Storytelling (DST) hasestablished a new dimension in the ancient art of narrative(Psomos&Kordaki, 2013). Through writing, podcast, video, and sequential art,almost any stories can be told in a digital environment. However, with substandard artistic skills, designing acomic is graduallyunachievable. Instead of illustrations, photo-based authoring tool such as *Comic Life* simply letsusersinsertavailable pictures withincomic panels (refer to Figure 2). Photo filters can be applied with combination of basic comic elements such as speech bubbles and text effects. Many web basedcomicdevelopment tool offerfile sharing functionality to immediately post author's comic strips in social networks.

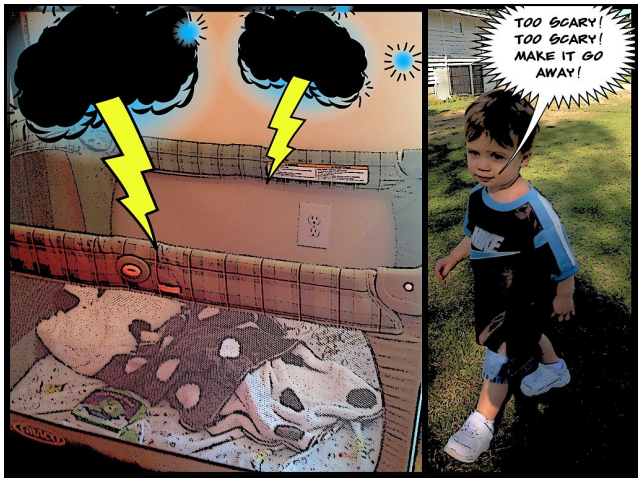

Figure 2 A Comic composed using Photo-based Authoring Tool(Source:Wikimedia Commons).

C. Premade Item Based

Unlike artwork and photo based comic tools, premade item based comic authoring programs do not require users to obtain external media to be integrated with comic elements.Tools such as *Bistrip,MakeBeliefsComix,*and *Pixton* supply ready-made items such as character sprites with different poses and emotions, props and background. Although this is highly convenient for novice storytellers, these tools do not provide the flexibly and freedom for professional artists to customize their comics. To facilitate the stages of comic construction Chen, Jablonsky, Margines, Gupta, & Thakkar (2013) have proposed a web-based portal design as platform for current events digestion.

V COMICSUSAGE IN EDUCATION

Astonishingly, empirical research of using comics and graphic novels in education have begun since the 1940s (Hutchinson, 1949). Nonetheless, a more recent study by Cooper, Nesmith, and Schwarz (2011), inform that although todays' educators are still initially cautious, they admit their varying amount of interest towards graphic novel usage for academic purpose.Figure 3 shows and example of digital comic strip for instructional purpose.

A. Subject-matter Content

Comics have contributed more than visual aids forlanguage and TESOL learners (Baker, 2011; Recine, 2013). In the referred studies, and in many others, linguistic items are acquired in incessant sequence without altering the readers' point of view.With fruitful results and implications, graphic novels have grownas supplementary tool in language teaching practices.

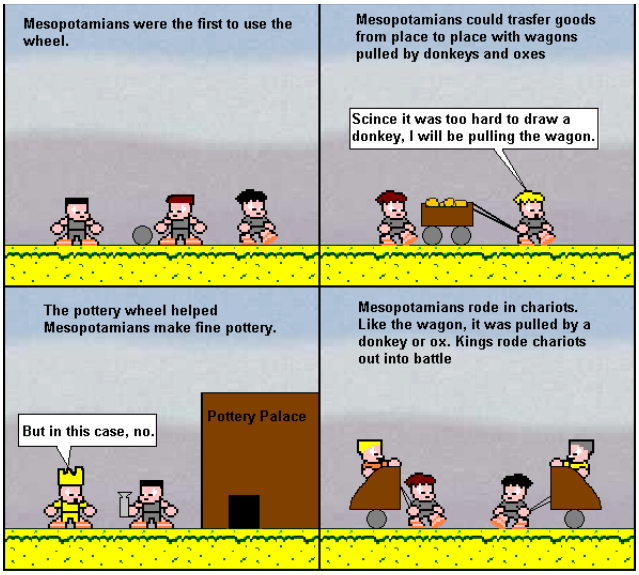

Figure 3. An Educational Comic (Source:Wikimedia Commons).

Content integrated in the comics can be either subject focused or isolated to the syllabus. As evaluated by Williams (2008), students practice moderate level of synthesis and thinking skills through by reading and reflecting through graphic novel. Dowdy (2011) has further explored comics' potential of motivating students through-out literacy process.

To engage middle school students in Geography lesson, integration of comics as part of learning materials is performed in Zombie-based Learning curriculum developmentproject (Hunter, 2012). The graphic novel establishes the story that carries student into different scenariowith clear learning objectivethroughout the game based learning course respectively (refer to Figure 4).

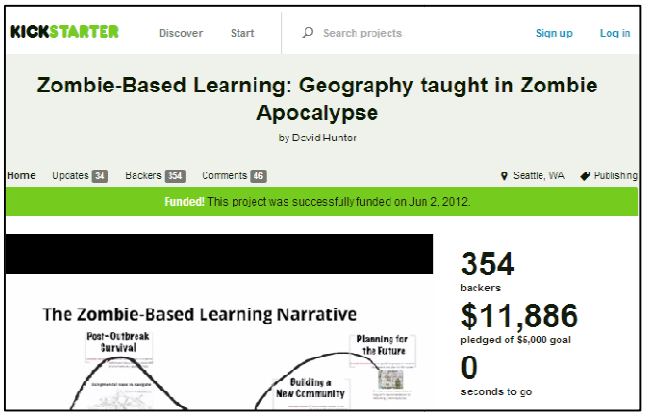

Figure 4. Zombie-Based Learning crowdfundedproject(Source:kickstarter.com/projects/hunterd/zombie-based-learning-geography-taught-in-zombie-a).

In response to young adults' interest in *manga* (Japanese comics), higher institutions such as the University of Minnesota, the University of Massachusetts andthe University of Texas have exhibited positive response towards embracing comic society (Krikke, 2006). As a result, Krikke (2006) has reported that one of the mentioned college is commissioned by NASA space agency to develop an on-neutral dynamics instructional *manga*.

One the other hand, comic is also considered as potential graphical tool to summarize other medium where Boreczky, Girgensohn, Golovchinsky, and Uchihashi(2000) haveconfirmed a comic-book-like presentation with varied panel sizes that provides important video passages access through keyframes entry points is more visually appealing to adults than fixed-size image summary. Besides video, Alves, Simões, Vala, Paiva, McMichael and Aylett (2007) has proposed a comic-strip summary from emergent narrative in games to attain memorable and better story understanding using comic strip description language.

Corresponding to the benefit of interactive comic features, Busarello, Ulbricht, Bieging, and Villarouco(2013)'s hypermedia comiclearning object has assisted learner's content assimilation and grant emotional appeal to deaf students in studying descriptive geometry respectively.

Although academic findings havearticulated the emboldening prospective of educational comics, Downey (2009) has highlighted that graphic novel selection process must involve the participation of content area experts to ensure the materials student read are obligatedto accurate, informative yet engaging content. This proposition is supported by Cooper et.al(2011) who suggest that to assist teachers in integrate comics in curriculum, evaluation of comics' validity should be conducted by librarians and professional organizations based on objective review guide instruments.

B. Comic Authoring

The increasing acceptance ofcomics manipulation in classroomis due their contribution to active studentengagement (Maliszewski, 2013). Grounded on carefully designed daily lesson plan, a comic authoringactivity trains students to organize, analyze, and synthesize information. This is performed by middle school students in Canada who have transformed their knowledge in social justice issues through graphic novellas design using *Bitstrips* program (Burke, Hughes, Hardware, & Thompson, 2013).Moreover, Higginbotham et. al(2012) have exploited *manga* as culture mainstay in a Japanese higher institution where students' language learning history is expressed by narrative construction using the mentioned comic authoring tool. Responding to these achievements, Peterson (2013) has described how multi-modal and print-based literacies skills are explored through hand-on class assignments including graphic novel development with*Comic Life*tool. As

shown in Figure 5, ELT students in Cambridge Universitydesign graphic novels with the college's online comic authoring tool as a fun, visual, and flexiblemechanism for language learning (Lewis, 2013).

Figure 5. Online Comic Builder by Cambridge University(Source:interactive.cambridge.org/index.php/students/comic-builder).

Subsequently according to the researcher's observation, the produced comics by students which are published online generally comprisepanels,speech bubbles with and without narrative at minimum. Biography, historical comicsand science contents comics are fairly instructive while non-restricted stories allow language practice. As stressed by Caldwell (2012), more academic studies are required to understand how comics can be informative instead of only concentrating on their attainments.

Despite educational comics' favorable outcome, Melor, Hadi, and Amin (2012) have issued that applying comic based activity is impractical due to time and internet access constraints. Protracted phase of crafting photographs and drawings to be utilized in authoring tools plus learning the software itself also contribute to this inconveniency. Since narrative is an imperative facet of graphic novels, design for storytelling implementation in educational comic authoring tools must be considered. Theme control remains a challenge when storytelling applications limit to pre-fixed plot and loose events composition(Schoenau-Fog, Bruni, Khalil, &Faizi, 2013).

VI CONCLUSION

To conclude, despite the technological evolution of comics, major visual and communication elements of this medium persist as a core in connecting with its' audience. This article has delineated the challenges of developing an accessible comic viewing systemfor diverse levels of readers in desktop and mobile platform. Moreover, professional and novice authors have a range of optionsto select innovative tools to incorporate their original illustration, 3D artwork, photos and pre-made objects into their graphic novel.It is also important for comic authoring tools tosupport interactive elements construction which could unlock the enlivening strength of hypermedia comics in standalone and web-based environment.

This paper has also highlightedthe mixed academia's response towards establishing graphic novels in elementary,secondary schools,and higher institution communities. While manyhave claimed encouraging results in comic integration is classroom setting, trivialtotal of scholars have questioned the evidence and applicabilityofthis educational method. Consequently, future experimentsmust ensue viable data to indorse both affective and cognitive effects of educational comics. Furthermore, there is a noticeable absence of research that harmonize academic content and story elements withinstudent-generated graphic novels. Finally, extendedanalysis should be carried out to contemplate the role and influence of culture in authoring educational personalized comics.

REFERENCES

Alves, T., Simões, A., Vala, M., Paiva, A., McMichael, A., & Aylett, R. (2007). From IVAs to Comics Generating Comic Strips from Emergent Stories with Autonomous Characters. In *Intelligent Virtual Agents* (pp. 350-351). Springer Berlin Heidelberg.

Andrews, D., & Baber, C. (2012). Creating and Using Interactive Narratives : Reading and Writing Branching Comics. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 1703–1712.

Arai, K., & Tolle, H. (2011). Method for real time text extraction of digital manga comic. *International Journal of Image Processing (IJIP), 4*(6), 669-676.

Baker, A. (2011). Using comics to improve literacy in English language learners.

Boreczky, J., Girgensohn, A., Golovchinsky, G., & Uchihashi, S. (2000). An interactive comic book presentation for exploring video. In *Proceedings of the SIGCHI conference on Human factors in computing systems - CHI '00* (pp. 185–192). New York, New York, USA: ACM Press. doi:10.1145/332040.332428

Burke, A., Hughes, J., Hardware, S., & Thompson, S. (2013). Adolescents as Agents of Change. *Education Matters: The Journal of Teaching and Learning, 1*(2).

Busarello, R. I., Ulbricht, V. R., Bieging, P., & Villarouco, V. (2013). Deaf students and comic hypermedia: proposal of accessible learning object. In *Universal Access in Human-Computer Interaction. Applications and Services for Quality of Life* (pp. 133-142). Springer Berlin Heidelberg.

Butler, C., Aaseng, M., D'Addario, D., Hallat, A., Campbell, J., & Keely, J. (2014). *The Art of Cartooning & Illustration*. Walter Foster.

Caldwell, J. (2012). Information Comics : an Overview. In *Proceedings of Professional Communication Conference (IPCC), 2012 IEEE International* (pp. 1–7). doi:10.1109/IPCC.2012.6408645

Chen, B., Jablonsky, R., Margines, J. B., Gupta, R., & Thakkar, S. (2013, April). Comic circuit: an online community for the creation and consumption of news comics. In *CHI'13 Extended Abstracts on Human Factors in Computing Systems* (pp. 2561-2566). ACM.

Cohn, N. (2013). Visual narrative structure. Cognitive science, 37(3), 413-452.

Cohn, N. (2013). Navigating comics: an empirical and theoretical approach to strategies of reading comic page layouts. *Frontiers in Psychology*, 4(April), 186. doi:10.3389/fpsyg.2013.00186

Di Blas, N., Garzotto, F., Paolini, P., & Sabiescu, A. (2009). Digital storytelling as a whole-class learning activity: Lessons from a three-years project. In *Interactive Storytelling* (pp. 14-25). Springer Berlin Heidelberg.

Downey, E. M. (2009). Graphic novels in curriculum and instruction collections. *Reference & User Services Quarterly*, 49(2), 181-188.

Dowdy, J. K. (2011). Comic Strips are Comic Plays. In *Teaching Drama in the Classroom* (pp. 33-35). SensePublishers.

Eisner, W. (1985). *Comics & sequential art* (pp. 194-209). Tamarac, FL: Poorhouse Press.

Higginbotham, G., Szirmai, M., Ikeda, K., Ducker, N., Nakamura, M., Mboutsiadis, B., & Porter, M. (2012). Development Beyond the Classroom. *The 2012 Pan-SIG Conference Proceedings: Literacy-SIGnals of Emergence*.

Horton, S. (2008). *Webcomics 2.0: An Insider's Guide to Writing, Drawing and Promoting Your Own Webcomics*. Course Technology Press.

Hunter, D. (2012, June 2). *Zombie-Based Learning: Geography taught in Zombie Apocalypse — Kickstarter*. Retrieved April 10, 2014, from https://www.kickstarter.com/projects/hunterd/dead-reckon-the-zombie-based-learning-graphic-nove

Hussain, K., Shahbodin, F., Bakar, N., & Hasan, H. (2011). Comparing Students' Perceptions of Blended Learning and Traditional Classroom Deliveries in an English Professional Communication Course in a Technical University.

Hutchinson, K. H. (1949). An experiment in the use of comics as instructional material. *Journal of Educational Sociology, 23*(4), 236–245.

In, Y., Oie, T., Higuchi, M., Kawasaki, S., Koike, A., & Murakami, H. (2011). Fast frame decomposition and sorting by contour tracing for mobile phone comic images. *Internatinal journal of systems applications, engineering and development, 5*(2), 216-223.

Kalthom, H., Aida N.A., Norasiken, B., Faaizah, S., Norshahidatul, H. I., Hazmilah, H. (2011). Comparing Students' Perceptions of Blended Learning and Traditional Classroom Deliveries in an English Professional Communication Course in a Technical University

Krikke, J. (2006). Computer graphics advances the art of anime. *Computer Graphics and Applications, IEEE*, 26(3), 14-19.

Lai, C. H., Bjornerud, P. M., Akahori, K., & Hayashi, S. (2002, December). The design and evaluation of language learning materials based on comic stories and comic strips. In *Computers in Education, 2002. Proceedings. International Conference on* (pp. 677-678). IEEE.

Lamerichs, N. (2013). The cultural dynamic of doujinshi and cosplay: Local anime fandom in Japan, USA and Europe. *Participations*, 10(1), 154-176.

Lewis, S. (2013, August 13). *Using graphic novels in the ELT classroom-The Cambridge University Press*. Retrieved April 14, 2014, from http://cambridgeindiaeltblog.wordpress.com/2013/08/13/using-graphic-novels-in-the-elt-classroom/

Maliszewski, D. (2013). *The Benefits of Writing Comics. Graphic Novels and Comics in the Classroom: Essays on the Educational Power of Sequential Art*, 233.

McCloud, S. (1993). *Understanding comics: The invisible art*. Northampton, Mass.

McCloud, S. (2000). *Reinventing comics: How imagination and technology are revolutionizing an art form*. New York: Perennial.

Melor, M. Y., Hadi, S., & Mohamed Amin, E. (2012). Effects of Using Digital Comics to Improve ESL Writing. *Research Journal of Applied Sciences, Engineering and Technology*, 4(18), 3462–3469.

Meskin, A. (2007). Defining comics?. The Journal of Aesthetics and Art Criticism, 65(4), 369-379.

Mitkus, T. (2013). Lithuanian Comics: Unused Cultural and Educations Instrument. *Coactivity: Philosophy, Communication/Santalka: Filosofija, Komunikacija, 21*(1), 21-34.

Nesmith, S., Cooper, S., & Schwarz, G. (2011). Exploring Graphic Novels for Elementary Science and Mathematics. *School Library Media Research*, 14.

Perry, G., & Aldridge, A. (1971). *The Penguin book of comics: A slight history*. Penguin books.

Peterson, S. S. (2013). Literacy Teacher Education to Support Children's Multi-Modal and Print-Based Literacies. In *Literacy Teacher Educators* (pp. 93-105). SensePublishers.

Ponsard, C., & Fries, V. (2009). Enhancing the accessibility for all of digital comic books. *Int. J. on Human-Computer Interaction (eMinds),* 1(5), 127-144.

Psomos, P., & Kordaki, M. (2013). Analysis of Educational Digital Storytelling Environments : The Use of the " Dimension Star " Model " Dimension Star ": An Evaluation Model for Digital. In *WSKS 2011* (pp. 317–322).

Rall, H. (2013). Information Graphics and Comics. In Interaktive Infografiken (pp. 175-215). Springer Berlin Heidelberg.

Recine, D. (2013). *Comics Aren't Just For Fun Anymore: The Practical Use of Comics by TESOL Professionals* (Doctoral dissertation, University of Wisconsin).

Rigaud, C., Tsopze, N., Burie, J. C., & Ogier, J. M. (2013). Robust frame and text extraction from comic books. In *Graphics Recognition. New Trends and Challenges* (pp. 129-138). Springer Berlin Heidelberg.

Sabin, R. (2001). *Comics, comix & graphic novels: A history of comic art.*

Schoenau-Fog, H., Bruni, L. E., Khalil, F. F., & Faizi, J. (2013). Authoring for Engagement in Plot-Based Interactive Dramatic Experiences for Learning. In *Transactions on Edutainment X* (pp. 1-19). Springer Berlin Heidelberg.

Steinke, J. (2004). Science in cyberspace: science and engineering World Wide Web sites for girls. *Public Understanding of Science*, 13(1), 7-30.

Tolle, H., & Arai, K. (2013, September). Manga content extraction method for automatic mobile comic content creation. In *Advanced Computer Science and Information Systems (ICACSIS), 2013 International Conference on* (pp. 321-328). IEEE.

Tsai, C. J., Yao, C. Y., Chiang, P. Y., Lai, Y. C., Chi, M. T., Chu, H. K., & Wang, Y. S. (2013, July). Adaptive manga re-layout on mobile device. In *ACM SIGGRAPH 2013 Posters* (p. 57). ACM.

Wandani, A. D., Wee, G., & Moses, W. (2011). Designing Interactive Mobile Comics for Multi-Touch Screen Phones. *International Conference on Future Information Technology (IPCSIT)* , 13, 332-336.

Williams, R. M. C. (2008). Image, text, and story: Comics and graphic novels in the classroom. *Teaching and Learning Publications*, 1.

Wong, T. T., Igarashi, T., Xu, Y. Q., & Shi, D. (2013, November). Computational manga and anime. In *SIGGRAPH Asia 2013 Courses* (p. 13). ACM.