A Revised Production Model of Learner-Generated Comic: Validation through Expert Review

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Abstract. Recent advancement of authoring tools has fostered a widespread interest towards using comics as a Digital Storytelling medium. This technology integrated learning approach is known as learner-generated comic production; where learners constructively produce digital stories in a form of educational comics. However, there were concerns towards the obstacles and challenges of producing learner-generated comics. Hence, a conceptual production model of learner-generated comic was proposed to guide learners in designing and developing digital educational comics. Accordingly, as the decision making stage for validating the proposed model, expert review method was adopted. Results of expert review were coded and classified into flexibility, understandability, completeness, generality, and usability aspects, aligning with dimension of conceptual model characteristics. Consequently, a final appraisal cycle with experts was conducted to approve the revised and redesigned LGC production model based on expert review. In summary, the experts concluded that the proposed model replicates the process of learner-generated comic production very well, visually and descriptively. Suggestion of future research is put forward.

1. Introduction

Recent advancement of authoring tools has fostered a widespread interest towards using comics as a Digital Storytelling medium. This technology integrated learning approach is known as Learner-Generated Comic (LGC) production; where learners produce digital stories in a form of educational comics [1].

According to [2], while learning "from" media and technology concentrates on encoded information in tutor tools, the focus of learning "with" media and technology approach is on the cognitive tools in constructivist environments. Cognitive tools require learners to think mindfully in order to use the application to represent what they know [3] and provide visual representations of tasks and facilitate learners towards their execution [4]. 'Media' on the other hand, is the symbol system that educators and learners use to represent knowledge; while 'technology' is the utilized tool to build and share their knowledge representations with others [2]. This denotes that LGC production belongs to learning "with" media and technology taxonomy; whereas digital educational comic is the symbol system in presenting knowledge.

To date, literature has rapidly reported on the potential, and benefits of LGC production (eg: [5], [6], [7]). However, although learners expressed high interest in LGC production, it was revealed that majority of them were concerned towards the obstacles they would encounter when producing LGC such as presentation of educational content, and utilization of comic elements and storytelling techniques into their LGC [8].

Hence, to undermine these challenges, a conceptual production model of LGC was proposed. As a cognitive tool [3], it was hypothesised that the LGC production model would significantly serve as a guideline for learners to design and develop digital educational comics.

Adopting Design Science Research methodology [9], the proposed model was structurally constructed through content analysis, comparative study of LGC classroom strategies, Digital Storytelling models and frameworks, expert consultation, and user participation. Principally, the core components of LGC production model were classified into phases and supported by task, activity, and flow subcomponents. Accordingly, the proposed production model of LGC was evaluated through user experience testing and expert review. Thus, this paper aims to discuss the selection of experts, findings, and results obtained from the review of LGC production model.

2. Expert Review

Essentially, expert reviews can occur early or late in the design phase [10]. In this study, expert review was chosen as the decision making stage for validating the proposed LGC production model. This was because experts recognize and understand the concept of heuristic [11]. Plus, to compound in trustworthy results, the experts investigated the features of the proposed model [12]. The

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results obtained from expert review were gathered to replicate several key questions of conceptual model evaluation [13] as follows:

- Are the facts described by the model accepted as correct by the domain experts?
- Are the described instances on the desired level of detail?
- Is the model conforming to necessary standards?

2.1 Instrument

The instrument design was based on previous expert review questionnaires [14, 15]. The questions ask about the (i) relevancy of the proposed phases which represent the main stages of LGC production, (ii) necessity of the proposed tasks and the activities within them, (iii) connections and flows of all of the components, (iv) usability of the proposed model, and (v) readability of the proposed model. The rest of the items were adapted from maturity model experts review instrument by [16] because they were specifically designed for model evaluation by domain experts.

2.2 Profile of Selected Experts

Eight experts were involved in this activity where majority of them have either theoretical or industrial contributions in comic field. The numbers of experts were regarded adequate as stated in the conditions set by [17]. Experts involved in the review process were selected based on the criteria described in Table 1.

Table 1. Criteria of Expert Selection

Category	Criteria
Academician	• Have PhD qualifications either in Human Computer Interaction (HCI) or Multimedia or Instructional Design or Art and Design related area OR/AND • Have been studying/researching either in comics, Human Computer Interaction (HCI) or Multimedia or Instructional Design or Art and Design related area for at least five years.
Practitioner	• Have at least five years of professional experience in comic industry.

Demographic information about the experts such as age, gender, position, and experience were collected to support the dependability of the selected experts in evaluating LGC production model (see Table 2).

2.3 Procedure

The review process started with the invitation via email to the identified experts. After the experts agreed and replied, the official appointment letter by the dean, and consent form were sent to them. Next, the experts received an illustration of the proposed model together with expert review form through email. The objective and scope of the proposed model were made clear to the experts where the target users are undergraduate students and the model of LGC production does not involve illustrating comics; but focuses on educational storytelling with the utilization of comic authoring software instead.

The experts were instructed to observe and analyse the supplied illustration and description of LGC production model before carefully filling up the provided spaces in the review form. The experts were required to note problematic features by inspecting the components and items relevancy in the model and predict potential problems when users interact with it. It took approximately four to ten weeks to accomplish the expert review process. The researcher also conducted a face to face meeting with four of the selected experts during the mentioned time frame.

Table 2. Demographic Profile of Experts

Expert	Gender	Age (Year)	Position	Academic Qualification	Affiliation	Experience (Year)
A	Male	55	Professor	PhD	Universiti Teknologi MARA	40
B	Male	44	Associate Professor	PhD	Ramapo College of New Jersey	24
C	Female	39	Associate Professor	PhD	University of North Florida	15
D	Male	46	Academician	PhD	Universiti Teknologi MARA	14
E	Female	42	Academician and Practitioner	PhD	Universiti Teknologi MARA and MOY Sdn Bhd	23
F	Female	33	Academician and Practitioner	Masters	Universiti Teknologi MARA and Gempakstarz	10
G	Male	37	Practitioner	Diploma	Comicore Creative Solution	12
H	Male	35	Practitioner	Bachelor Degree	ABS Holdings	6

3. Findings and Discussion

Initially, results from the expert review demonstrated that; although majority of them approved most components proposed in the model, there were moderate agreement towards "Scriptwriting" phase and "Characters" and "Basic" tasks (refer to Fig 1 and Fig 2). The experts however has come to agreement that the proposed model is usable, has logical flow, and the terminology used is understandable.
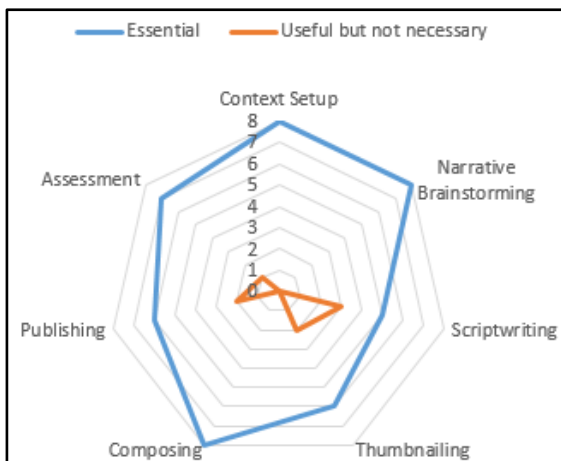

Fig. 1. Frequency of the proposed phases' relevance in LGC production model.
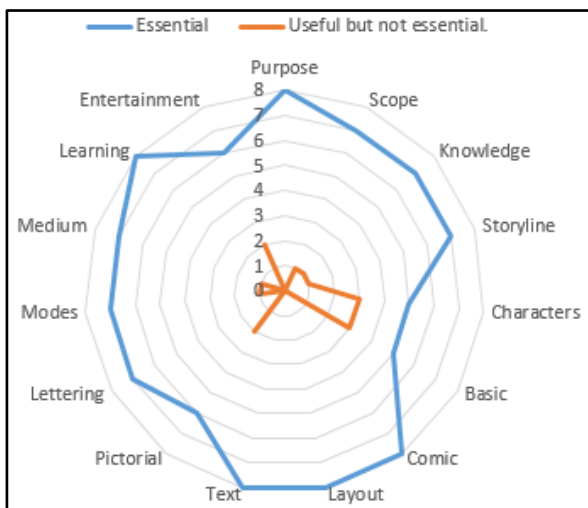

Fig. 2. Frequency of the proposed tasks' relevance in LGC production model.

To further contemplate the feedbacks given by the experts, all of the experts' written comments were also qualitatively analysed. In conveying the clearer meaning, some of the comments were rephrased from the original versions as exhibited in Table 3.

Table 3. Further Comments from the Experts

Expert	Comments
A	(1) Target audience should be included in The Context Setup phase. For example, younger audience. (2) In Narrative Brainstorming phase (narrative type), may include daily scenes and symbols. (3) The description under Character activity may include the aspect of size and physical appearance. Dialogue must be appropriate for target readers. (4) The model is understandable, practical and flexible. (5) Overall, it is very important to identify the target reader, audience or user of the comic from the beginning of the process. This will determine the suitability of the following process.
B	(1) Context Setup phase is very important as it sets up the very purpose of the project. (2) You did a nice job in giving the scope of how students should pull together their ideas for the project. (3) You might add a discussion activity as part of Narrative Brainstorming or after it. It would be good for students to provide feedback for each other as they begin to plan and craft their comics. (4) Scriptwriting or Thumbnailing is certainly something to include, but given the time constraints of a typical classroom, perhaps it is something you would consider making optional. (5) Good job with giving a broad range of Composing phase options in this field. Perhaps consider providing ideas for outlets for publication/exhibition of the comics in Publishing phase. (6) I like how Assessment phase component is included so that there is a clear outcome to work toward. (7) Model description is very clear and understandable. (8) You have done an excellent job in the creation of this model. You have provided a very usable and effective model. I think it will be very useful and effective for educators. As you move forward, you may want to provide actual examples of these steps in action, perhaps through video. You might also consider providing an addendum to the model for classrooms that don't have immediate access to technology (that is, using hand-drawn comics). Overall, I think this is excellent work.
C	(1) How are you defining Basic phase? Basic of what? (2) Yes, the model will have logical flow, usable and readable once you fixed it. Refer to my notes. (3) How are Layout and Pictorial tasks different? Please specify. (4) Text and Lettering tasks seem to be overlapping too much. Are they more similar or different? (5) I can't wait to see how well this goes. Super fantastic project!

D	(1)	Typography is essential because it defines the comic appeal.
	(2)	Anthropomorphic should be added to assess character design.
	(3)	Characters could be grouped under Storyline task.
	(4)	Add narrative structure such as Gustar Freytag model in the description.
	(5)	Overall, the model has listed all the necessary components for developing comic. However, it could also consider inserting these elements – content analysis, Freytag analysis, and anthropomorphism.
E	(1)	Add symbol and semiotic elements into the model.
	(2)	Character is considered an element in Storyline.
	(3)	The model should be readable in monochrome. Therefore, consider eliminating colours for the phases' blocks.
	(4)	Visually, the model does not require complex shape for each phases to avoid confusion. Stick to consistent shape for every proposed phase.
	(5)	The model should be able to deliver message in a simpler way.
F	(1)	The Context Setup is very essential for setting up the foundation for whole production. Narrative Brainstorming is important for group project. Scriptwriting is not essential because this usually can be included in thumbnail process. Thumbnailing is important because the Rough detail sketches fasten the next process. Composing is required for quality control can be made at this time before publish. Publishing save all the documentation and makes the final product run smoothly.
	(2)	For comic publishing stage, I would add up special phase for digital development process especially for Androids and OS platform. Finishing up the comic is just a first part of the game, the other half is to make sure the comic run smoothly in variety platforms in every screen size of gadgets. Tasks for animated and Interactive comics should be considered by adding GIFs, or essential GUI (Graphic User interface) to be put for easy reading in the digital platform. Simple games can also be added to make the digital comics more interactive. (can easily be done in Flash or Construct).
	(3)	The word 'Iconography' it is kind a bit off for visual metaphor representation in comic process. There is no definite term for this stage but I can only explain it to people as the 'exaggerated symbols' that defines movement and emotion in static world in comics.
	(4)	I love the presentation of the chart flow of the production, but need more detail explanation based on different learning scopes.
	(5)	The model it can be visually practical and understandable, the pipeline description in interactive infographics will be nice.

G	(1)	I would not recommend Scriptwriting to be an essential phase because this phase process can be done when thumbnailing the comic.
	(2)	Overall, the model is a decent guideline for effective comic production. But it is up to the comic artist to decide which his/her own preferable methods in developing comics.
H	(1)	The model is adaptable for developing comic for different lesson/subjects.
	(2)	The model could include examples from the proposed components.
	(3)	The theme of comic should be clear.
	(4)	Since the aim of educational comic is to motivate learning, help understanding content and encourage high level of thinking, this model is helpful for facilitating the process to achieve those aims through comic development.

Given the mixed results towards certain phases and tasks depicted in Fig. 1 and Fig. 2, the feedback and suggestions from experts in Table 3 were analysed and considered in refining the proposed model. Aligning with dimension of conceptual model characteristics [18], the expert comments from the review were coded and classified into flexibility, understandability, completeness, generality, and usability aspects.
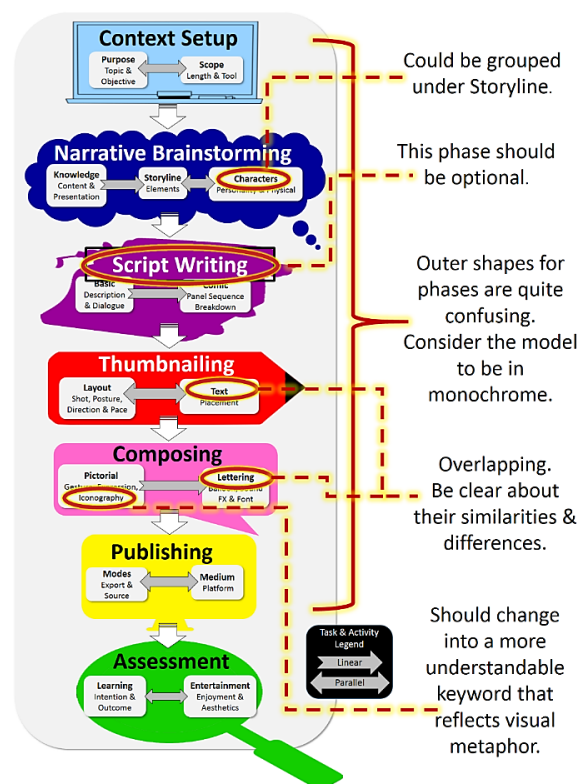

Fig. 3. Several commentary towards LGC production model.

The most apparent critique was towards the flexibility aspect on LGC production model. Primarily, three experts stated "Scriptwriting" phase as useful but not essential. Accordingly, since some practitioners directly draft their script into the sketch thumbnails, Expert F and Expert G recommended that "Scriptwriting" and "Thumbnailing" "phases should be combined. In fact, Expect B prompted

that these two phases should be optional due to constraints of a typical classroom. Moreover, Expert C argued that the "Text" task within "Scriptwriting" seems to be intersecting with "Lettering". Hence, to tailor these issues, the "Text" task was replaced by "Script" task and merged under the "Thumbnailing" phase. These criticisms were decisively accepted by the researcher because it had been proven in the user experience testing stage where several participants concentrated straightforwardly on their thumbnails layout rather than the story script. In addition, the revised model also grouped "Character" as an activity within the "Storyline" task as recommended by Expert D and Expert E.

Secondly, the focus was on the understandability aspect of the proposed model. Answering Expert E's comments regarding the visual representation of LGC production model, readability of the diagram could be improved without confusing phase shapes. For example, during the user experience testing activity, participants could not figure out the typewriter shape for "Scriptwriting" phase and computer monitor for "Publishing" phase. Thus, this study visually revised the model by using consistent rounded rectangle shape for each phases. However, Expert E's suggestion on modifying the diagram colours was omitted. This was because the colours matched with the phases' description referred during LGC production. Regarding Expert F's critique about "Iconography" keyword, after a discussion with Expert D and F, this was changed into "Visual Metaphor".

Next, the completeness aspects from the review were scrutinised. First, inclusion of content analysis, narrative models, and anthropomorphism was suggested by Expert D. As a response, the first two elements were embedded in "Knowledge" and "Storyline" tasks with the "Narrative Brainstorming" phase. Depending on the LGC's story, anthropomorphism would be an optional element under the "Character" task. Secondly, addition of symbol and semiotic were proposed by Expert E. These elements were considered inclusive in "Pictorial" and "Text" tasks within "Composing" phase. Thirdly, as addressed by Expert H, the theme element had already included in the "Purpose" task. Fourthly, Expert A highlighted the importance of target audience to be included in the model. This element is certainly associated with the Purpose task. When "Topic" and "Objective" are defined, target audience should also be relatively clarified by the learner. As a whole, most of the suggested elements by experts were included in the revised description section of LGC production model.

The ensuing review focused on generality aspect. Concerning Expert C's argument on the difference between "Layout" and "Pictorial" tasks, the clarification were made in the model description. Despite their resemblance, "Layout" task concentrated on experimenting with the visuals before intensifying them during "Pictorial" task. Although Expert B evoked that discussion should be added into the model, Expert F exclaimed that this embedded activity is more relevant to group projects within "Narrative Brainstorming" phase. In regards to Expert E's recommendation to add a specific process in assuring the comic run smoothly in variety

platforms in every screen size of gadgets, this element had been included in "Medium" task within the "Publishing" phase. Thus, responding to the experts' recommendations, these suggested elements were included in the revised description section of LGC production model.

Finally, Expert B, Expert F, and Expert H emphasized on the usability aspect of the proposed model. For instance, Expert B suggested actual examples of LGC production process in action through video. Expert F on the other hand preferred an interactive infographic version of proposed model. Lastly, Expert H advocated to provide examples of the components proposed in LGC production model. These useful feedback were taken into major consideration in future study. This study undoubtedly acknowledged that a multimedia representation of the proposed model is an efficient factor in improving LGC production implementation.

4. Results and Conclusion

Lastly, a final appraisal cycle with experts was conducted to approve the revised and redesigned LGC production model based on expert review as illustrated in Fig. 4. Expert C, Expert F, and Expert H committed to this activity.
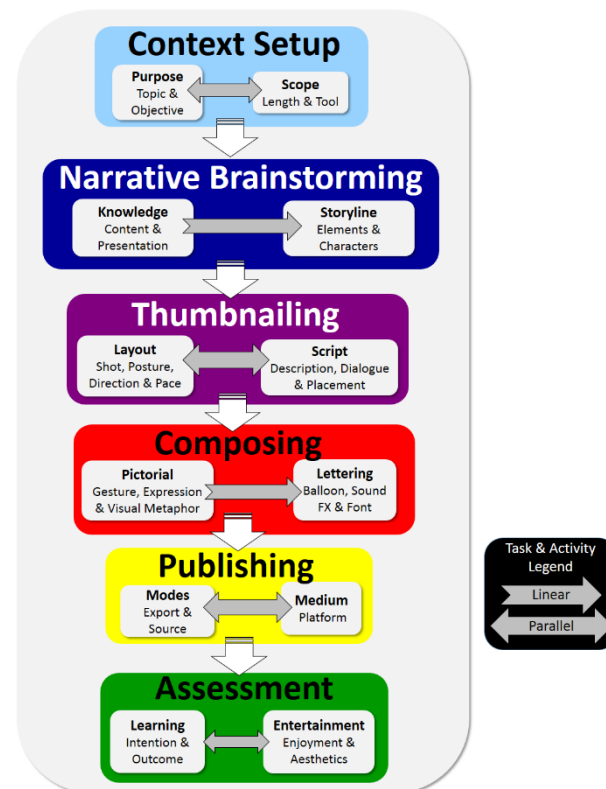

Fig. 4. Revised production model of LGC.

In summary, the experts concluded that the proposed model replicates the process of LGC production very well, visually and descriptively. At this rate, the production model of LGC has been thoroughly validated. In general, the components and description in LGC production model were revised based on the quantitative and qualitative data from expert review. Ultimately, the proposed LGC production model reflects the novelty and

practicability of the relevant theories pertaining to comic and multimedia production. This provides new means for educators to adopt solid model of LGC production into their project-based learning classroom practice. Thus, future works should explore on extending the proposed model encompassing production of motion and interactive educational comics.

References

1. F.N. Azman, S.B. Zaibon, & N. Shiratuddin, Journal of Theoretical and Applied Information Technology **89**, 2, 461-469 (2016)

2. D. H. Jonassen, & T. C. Reeves, *Handbook of Research for Educational Communications and Technology* (Macmillan, New York, 1996)

3. D. H. Jonassen, *ITForum Paper*, 67–80 (1994)

4. E. Tambouris, M. Zotou, K. Tarabanis, Education and Information Technologies, **19**, 1 , 61–86 (2014)

5. M. J. Green, Journal of Medical Humanities, **34**, 4, 471–476 (2013)

6. R. D. Watkins, PhD Thesis. Iowa State University (2014)

7. K. Comer, Composition Studies, **43**, 1, 75–104 (2015)

8. F.N. Azman, S.B. Zaibon, N. Shiratuddin, International Review of Management and Marketing **6**, 8S (2016)

9. V. Vaishnavi & B. Kuechler, *Design Science Research Methods and Patterns: Innovating Information and Communication Technology*. (CRC Press, New York, 2007)

10. B. Shneiderman & C. Plaisant, *Designing the User Interface* (Pearson, Addison-Wesley, 2005).

11. S. A. Aziz, S. N. A. Salam, A. A. Mutalib, S. Ismail, Journal of Telecommunication, Electronic and Computer Engineering (JTEC) **8**, 8 (2016)

12. P. Psomos & M. Kordaki, *Procedia - Social and Behavioral Sciences*, 46, 2012, 1213–1218 (2012)

13. F. Wolff & U. Frank, *13th European Conference on Information Systems, Information Systems in a Rapidly Changing Economy, ECIS 2005*, 1283–1294 (2005).

14. S. M. Sarif, PhD Thesis, Universiti Utara Malaysia (2011)

15. N. Aziz, PhD Thesis, Universiti Utara Malaysia (2014)

16. D. Salah, R Paige & P. Cairns, *Product-Focused Software Process Improvement. PROFES 2014. Lecture Notes in Computer Science*, Springer, 8892 (2014)

17. J. Nielsen, *Proceedings of the third international conference on human-computer interaction on Designing and using human-computer interfaces and knowledge based systems,* 394–401 (1989).

18. F.N. Azman, S.B. Zaibon, & N. Shiratuddin, International Journal Of Interactive Digital Media, **4**, 2, 28-32 (2016)