Improving Thinking Awareness in Animation Scriptwriting Through Learning Supporting Tool

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Abstract: In the media industry, there is a high demand for animation films, leading to the establishment of animation film courses in various universities to train future animators. However, writing animation scripts poses challenges for students, as it requires critical thinking skills to craft captivating and coherent story ideas, akin to other creative works that adhere to general principles for a complete and logical narrative. To solve this issue, we developed a tool as part of our project to help students systematically organize the essential components of a story based on the fundamental principles of animation, consisting of three acts. This tool creates a conducive learning environment by breaking down crucial elements into clear sections, prompting students to reflect on their own ideas about animation stories. Additionally, the tool encourages collaboration between students and instructors, enabling constructive feedback and reflections through error corrections. The results of our experiments showed significant improvements in students' development after using the tool. Notably, the recurring errors in omitting vital parts of the script did not reoccur after the initial use of the tool. Its implementation heightened students' awareness of the importance of each component. Furthermore, the assessment scores of all students demonstrated a significant improvement, with 34% of students displaying increased awareness in scriptwriting. The elements that students commonly missed were 'conflict' and 'progression of complications,' respectively.

Keywords: scriptwriting theory, learning supporting tool, awareness of thought

1. Introduction

Animation is one of the creative media that can engage audiences with interesting stories and expressions of imagination (Redvall, 2009). Because animated films are more visually appealing and reach more imaginative possibilities than movies at a lower cost. In addition to the above, animated films are important in other areas such as education or marketing and advertising. By education, animation is used extensively in educational materials and e-learning platforms. It helps simplify complex concepts, making learning engaging and accessible for students of all ages or animation is widely used in marketing and advertising campaigns. For marketing and advertising, animated advertisements, explainer videos, and animated graphics help capture the attention of consumers. Additionally, animated media effectively communicates messages to consumers.

Currently, teaching and learning in the field of animation and digital media are popular among university students in Thailand. Learning about animation development in classrooms involves teaching from creating digital media to scriptwriting for animation films. Upon evaluating the teaching and learning in the aforementioned field between teachers and

students. We found that in the subjects of theory and scriptwriting, they are among the most challenging topics for students to comprehend. Because it requires creative thinking coupled with a theoretical understanding of the essential elements of writing, including narrative techniques to captivate and engage the audience. Including creating an interesting story with clear elements is also important for screenplays and animated screenplays. It's important to keep the plot running smoothly and logically.

In this work, we develop a tool to help students to conceptualize components in their animation scripts into explicit objects. With the use of an ontology, conceptualized components are connected following script theory (Demorest & Alexander, 1992). This will help both students to recheck their idea and instructors to point out the mistakes. Moreover, the students will become more aware of necessary script elements and train their story composing for improvement.

2. Background
2.1 Basic Theory in Animation Script Writing

Fundamentally, a script for an animation is similar to a screenplay of other medias including movie and theater play as they share common elements (Scott, 2003). An animation script is a form of literary as it is intended to be interpreted by other such as producer, graphic designer, illustrator, and voice actor. Therefore, an animation script is not an end-product that audiences can directly enjoy. Apparently, an animation script is written using technical jargon and tight, spare prose when describing stage directions. Unlike a novel or short story (Marx, 2021), an animation script focuses on describing the literal, visual aspects of the story, rather than on the internal thoughts of its characters. Hence, the aim of script writing is to evoke thoughts and emotions through subtext, action, and symbolism.

The general script writing theory is an approach to organize the structure, goals and techniques of writing a script in a systematic fashion. The common and widely used structure of a script is a 'three act structure' (Ladopoulou and Dimitriadis, 2022). The three acts include a setup (first act), a confrontation (second act) and a resolution (third act) (Khalili, 2018) . Ratio of the acts is 25:50:25 percent for setup act, confrontation act, and resolution act, respectively.
- The setup act is to establish and to introduce the main characters, their relationships to other characters, and the world and its setting. In the later of first act, an inciting incident, known as the first plot point, is launched to raise a dramatic question that will be answered in a later act for the climax.
- The confrontation act features the main characters and their attempt to resolve the problem from the first turning point. In this act, a character development is introduced with the aid of other characters.
- The resolution act gives the resolution of the story. In this act, climax is mentioned as a sequence of the story are brought to the most intense point and an answer to the given dramatic question.

Besides the common 'three act structure', four or five acts are also proposed, but they are more complex and not suitable for novice script writers. Hence, this work focuses on gathering concepts related to the 'three act structure'.

For elements in an animation script, this depends on the respective act. However, the common elements are such as characters and their characteristics, locations of the stage, time of the scene, and major incidents of the story. These elements should not be in conflict to prevent a mazy viewpoint, and they should be carefully designed to logically relate to one another. The quality of a script is normally assessed by scriptwriting rubric (Gutierrez, 2014).

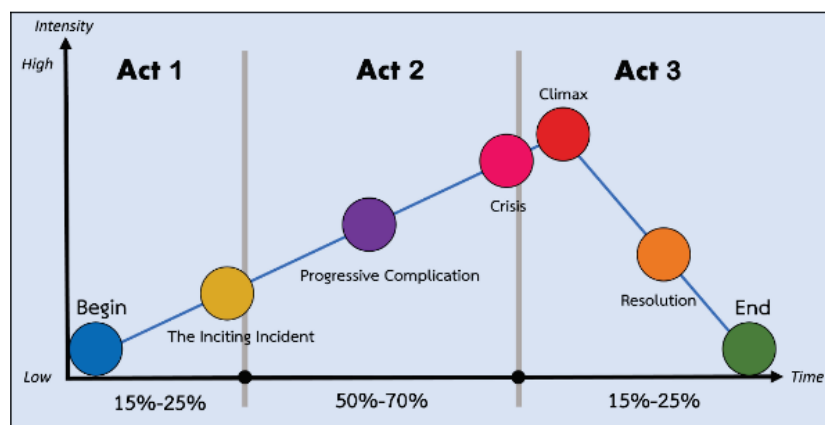Components in 3-act script paradigm is shown in Figure 1.

Figure 1. Components in 3-act script paradigm

2.2 Writing Supporting System

To assist on education, several researchers developed a tool on supporting writing learning. They design a tool with the environment to help students and instructors on improving writing expertise. We survey writing supporting systems and found the information given in Table 1.

Table. 1 Related work on supporting tool for improving a writing skill

Tool	Correction	Suggestion	Environment	Criteria	Collaborative
Eagle	Grammar	Error Location, Error Type	- Teacher hints the error location - Students consider error type and correct them	Error Type Structure based on "mistake" or "missing" type	Yes
SWAN	Content	Rewriting Sentence	- Apply NLP Parser to understand sentence structure - Highlight color to represent Fluidity	Fluidity (Connect, Inverted Topic, Out-of-Sync, Disconnected)	No
ArgRewrite	Content/ Grammar	Rewriting Sentences which labeled type	- Give statistics of document composition - Students reconsider the suggested sentence	Revision Type :Text based/Surface based type	No
TBeW	Content/ Thinkingg	Writing Sentence which Content Type and Relational Sentence	- Write Sentence - Connect Sentence Declare Sentence Rational	Assist learner to understand their own thinking	Yes
TBeR	Analyze/ Thinking	Reading good academic articles	- Reading Sentence - Analyzing logical content - Analyzing relations between content	Assist learner to understand author's thinking systematically	Yes

In summary, Eagle (Takhom et al., 2011) is a tool for learning English as a foreign language for Thai students. It aims to improve understanding of English gramma with a collaboration between teachers and students. The tool allows teacher users to point out mistakes in written essays by assigning types of error for students to realize the mistake as well as keeping a log of editions made by students. SWAN (Kinnunen et al., 2012) is an assisting tool for writing scientific English content by providing an interface to guide the separation of content into required sections. The tool aims to help novice writers to understand purposes and relevant information of each section. ArgRewrite (Zhang et al., 2016) is a tool for learning a writing skill. It provides grammatical structure and vocabulary checking assistance to label errors in a English written sentence. It allows users to rewrite based on found errors by aiming to change writing behavior for the better. TBeW (Na Chai et al., 2017) and TBeR (Na Chai et al., 2019) is a framework that allows user to write and read content regardless of language used to understand the intention of content. This will help users to train their cognitive skills to think about thinking (metacognitive skill). The framework focuses on the awareness of how to represent the idea correctly in writing and how to determine the strategy to represent thought of author in reading.

From the review, we found that the tools can be categorized into two types. First type is a tool that allows student to learn how to write while the tool provides supportive functions to assist on learning. Second type is a tool providing environment for students to collaborate with peers for sharing opinions and written content to inspire each other and learn from other's examples. The key concepts of these supporting tools are to let students become aware of their own mistakes and improve from it by getting instructor comment or realizing them from examples. These tools thus assist students to learn more effectively than traditional lectures. Furthermore, most of the tools are online-based application and can be accessed flexibly via a personal computer, smart phones, and tablets. The tools hence help to promote learning from anywhere-anytime and life-long learning.

3. Methodology
3.1 Design of the animation script writing tool

In this work, we design a tool to help on a task of animation script writing for students (WriterDuet, 2022). The tool allows students to describe the components in an animation script into distinguised objects and assigns relationship among them freely. The tool applies the existing ontology called animation script ontology to control semantic meaning of the script components. An overview of the tool is shown in Figure 2.

Based on the illustrated overview, the core components of the tool are the ontology, the database to store conceptualized objects of an animation script, and user interface for users to provide and retrieve script information. The tool is designed for 2 user roles as students and instructors. The students are to provide the idea of the animation story in details in the provided user interface while the instructors play a role to explore the given information to detect issues regarding theoretical details of script writing and give comments for students to correct the mistakes.
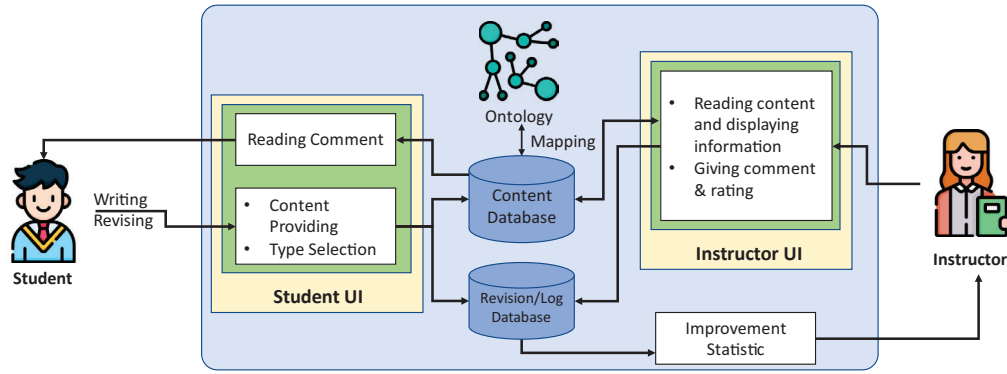
Figure 2. An overview of the proposed tool

3.1.1 Ontology as a knowledge base

The chosen ontology consists of ontological concepts about animation script components and relations among them. The core concepts are listed in Table 2. The ontology component type include a class and a property. The components must be named differently. As an ontology provides the knowledge regarding of animation script components, we gain a privilege of ontology benefits including ontology axioms to describe how concepts are related and connected semantically. However, we selected some part of knowledge from the ontology that matches the focus of this work. In this work, we focus on the common paradigm of animation scripts which consists of 3 acts according to the knowledge from the applied ontology as illustrated in Figure 1. From the figure mentioned, the 3 acts are a phase of the story while there are specific events which exist for a certain purpose in each phase. In summary, there are 7 essential components shown in Table 3 (Panadda et al., 2023).

Table. 2 Details of the applied ontology and its classes

Component Name	Type	Definition	Properties
Script	Class	A main division of a script following structural theory	- OP: has_incident [Event] - OP: has_setting [Setting]
Character	Class	a live form in an animation	- DP: has_name {string} - OP: has_characteristic [Characteristic] - OP: has_family-relation to [Character] - OP: has_relation_to [Character] …
Setting	Class	Place, Time, Condition, and Environment of a story	-None-
Event	Class	a noteworthy happening in a story	- OP: involved_character [character] - DP: located_in {string} - OP: caused_by_prior_event [Event]

Script component			
has_family-relation_to	Property	Familial relationship among character	-None-
has_relation_to	Property	Relationship among character	-None-

Table. 3 Animation script components and their specification

Script component	Description
Act 1	Introduction of the story including location setting, main characters, and specific conditions of the created story
• Begin	A starting of the story
• The inciting incident	An event that stimulates the story
Act 2	Provision of details of problems and solutions
• Progressive Complication	An event that increases more issues in the story
• Crisis	An event that leads to the critical issue
Act 3	Solving issue and Conclusion
• Climax	The most intensive decisive moment of the story
• Solution	An event that solves the issues
• End	Conclusion of the story

As shown in Figure 1, the acts are in sequence; hence, the relation of the acts are important to relay the story, especially for students who are yet excel in composing story. Furthermore, another important aspect in this study is to appropriateness of using the benefit of being animation movie. Thus, aside for completeness of the script details based on components, the soundness of each components part and aspect of animation appropriateness are also considered as essential in this work.

3.1.2   User interface

With the aforementioned aspects, we design the user interface (UI) for students to fill in information of their scripts. The information includes title, story theme, character details, setting, and script components. The UI provides slots for each type of components separately, so each piece of information is objectified and differentiated. This will help students to become aware of the flaw of ideas while using the tool as well as realizing of their own thought. The screen-captured UI for script components is exemplified in Figure 3.
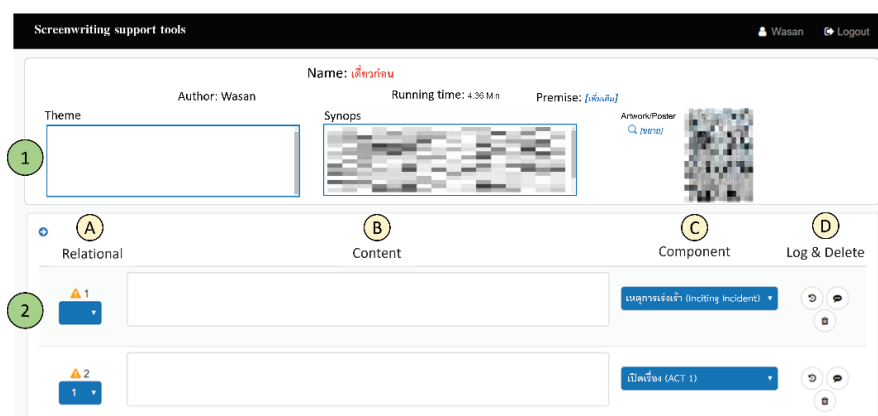

Figure 3. Screen-captured UI of the tool for providing script components

From the screen captured UI, the (1) part is where students provide a theme of a script with additional information including summary and image (optional). The (2) part is where students give script details including the content (B) of each part and assigning the script component (C) to indicate the type of the given content of each slot roll. The list of components for selection follows the information given in Table 2. Students are also asked to assign relationship (A) of each content. Last, students can reach an instructor's comment from (D).

The information given in each slot is collected in a database and able to be retrieved for self-corrected and examined by instructors. For the instructor role, the tool provides a space for commenting on each component, and the comments are shown to users to reflect on mistakes.

3.2 Providing Goal of the animation scriptwriting

The tool is used in lecturing in a course of training writing an animation script. According to the design, instructors can examine the completeness of script components, soundness of each component, and appropriateness of being animation movie. For details, description of each examining is given in Table 4.

Table. 4 Animation script components and their specification

Examining aspect	Criteria
Completeness of script components	Checking if an animation script is completed according to theory of 7 components
Soundness of each component	Checking if each component is correct to its description or not
Interestingness of the script	Checking understanding of the theory and how it can be applied to creativity
Appropriateness of being animation movie	Checking overall story that it takes benefit of being animation into account or not

3.3 Feedback from Coach

From the criteria, instructors can realize that what mistakes students make and provide a comment sufficient for students to correct them accordingly. Moreover, the collected information of scripts is stored in a database which can be used further in understanding the issue in teaching material or finding what needs to be focused for different groups of students.The coach is asked to provide feedback on the annotations. The options for the feedback 'agree' and 'disagree' while the 'disagree' has the option to provide additional comment on how the coach disagrees on the annotation. Particularly, the coaches are not suggested to give the correct answer directly, but the guidance on how to think to reach that conclusion. This will help to instill the correct cognitive process and the chance for learners to think about their way of thinking.

4. Experiment
4.1 Experimental Results

To evaluate the effect of the tool, we set up participants in this experiment were 42 students who studied in a course of principles of animation and directing animation. The participants were asked to write 3 short animation scripts using the tool. For each script, there were 2 rounds for providing information. Each round allotted for 4 hours per round, and there were 7-day interval time from previous round. For each script information providing, the first round was an initial round where the participants provided the script information by themselves, and 3 instructors as evaluators examined the information and provided feedback to students. The second round was a reflected round which was for students to correct the

mistakes following the comment and allowed to edit the script components by their free will.

In this experiment, there were 3 evaluators who evaluated the given information independently based on criteria given in Table 3. For evaluators, evaluation measurement metric of information was as given in Table 5.

Table. 5 Evaluation measurement metric for each aspect

Aspect	Measurement
Completeness of script components	Range of 1 to 7 according to existing components in the given information from students
Soundness of each component (7 components)	1 to 5 where 1 is lowest and 5 is highest (subjective to evaluators)
Interestingness of the script	1 to 5 where 1 is poor and 5 is excellent (subjective to evaluators)
Appropriateness of being animation movie	yes or no

From 3 evaluators, the voting method was used to finalize the evaluation for aspect of completeness of script components, and appropriateness of being animation movie. For soundness of each component, the mode score was used to represent the final score of each of 7 elements. The evaluation results are split in 6 rounds as given in Table 6.

Table. 6 The evaluation results

	Round of first script	Round of second script	Round of third script
Initial	I-1	I-2	I-3
Reflected	R-1	R-2	R-3

The evaluation results of the aspect of completeness of script components, soundness of each component, and appropriateness of being animation movie are given in Table 7 and Table 8, respectively.

From the results, we found that students show noticeable improvement after using the tool, especially on aspect of completeness. By comparing results of I-1, I-2 and I-3, the result of all aspects indicate that students realized the mistakes in their prior attempts and stably improved the score. For the aspect of soundness of component, the score of students were separated into 3 groups based on total score where score group of 29-35 indicated students who did at least 4 points in average in all components. The results showed that the number of students who were in this group was increased in 'reflected round' comparing to its own initial round. Furthermore, the number of students in higher point group were increased when comparing between first script, second script and third script. The results of the aspect of appropriateness of being animation also showed improvement.

Table. 7 Evaluation results of the aspect of soundness of component based on rounds

		Rating Score	I-1	R-1	I-2	R-2	I-3	R-3
Act 1	Begin	1-5	2	3	3	4	3	4
	The Inciting Incident	1-5	2	3	2	3	3	4
Act 2	Progressive Complication	1-5	1	2	2	3	3	4
	Crisis	1-5	0	2	0	3	3	3
Act 3	Climax	1-5	1	3	2	3	3	4
	Resolution	1-5	2	3	2	4	3	4
	End	1-5	1	3	2	4	3	4
Total score (0-35 points)	**Overall**	0-21	39	12	33	9	7	6
		22-28	3	24	9	25	33	21
		29-35	0	6	0	8	2	15

Table. 8 Evaluation results of the aspect of completeness of script components based on rounds

Number of missing components	I-1	R-1	I-2	R-2	I-3	R-3
Missing 2 or more	5	2	3	0	1	0
Missing 1	9	3	5	0	2	0
No-missing	28	37	34	42	39	42

4.2 Discussion

From the experimental results, we can conclude that the tool helps students to improve their understanding and scope their thoughts/idea on script details. Thus, we aim to see how much students improved. We thus compare the score of the same students from the initial test (I) and reflect (R). By analyzing, we found the improvement rate of students in writing the first script and second script via the proposed tool as shown in Figure 4 and 5 respectively.
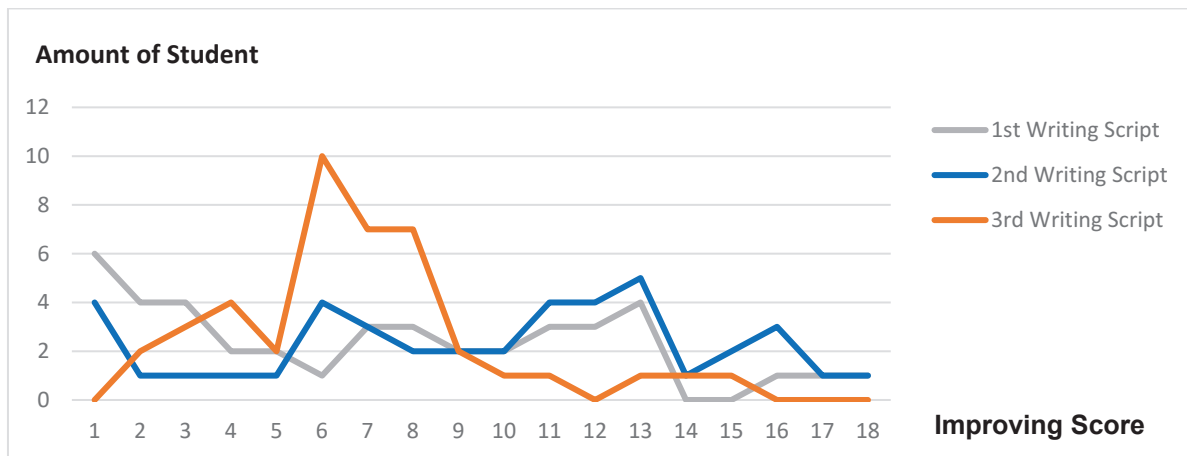

Figure 4. Comparison graph of score improvement between 1st, 2nd and 3rd written script

The improvement of students from Figure.4 show that all students improved from the initial round to the reflect round in the first, the second and the third script, but the improved score varied individually. These students were mostly in 0-21 score group and made the improvement to the mid-score group (22-28 score) and high score group (29-35 score) after reflection. The highest improved score was 18 higher score in the first script. The score improvement on the second script was averagely lower than the first script since the score initial round of the second script was noticeably higher than the first script.

In terms of common mistakes, the experimental results show that most missing components were components in Act2 including 'Crisis' and 'Progressive Complication', respectively. However, the tool helped to clearly see the required components, and students did not make this missing component again in the later round. This issue was hard to teach in traditional lectures since it is difficult to point out the missing part. This thus shows that the tool can help students to realize what is required as the basis of script writing.

5. Conclusion

This work proposes a tool to support the learning of animation script writing. By developing an environment with clear requirements of script components based on related theory, students can realize what is needed to compose a complete and sound script. The tool allows students to systematically design the story and them of a script by decomposing the thought/idea into distinguished parts and assigning relations among them. Instructors can hence examine the part separately to find mistakes and give feedback for students to correct and reflect on their issues. This will help students to remember how to design with error examples so they would not make such mistakes again. From the experiment results, the students showed improvement in all focused aspects including completeness of script components, soundness of each component, and appropriateness of being animation movie. All students show progressive improvement as the evaluated score on the second script was averagely higher than the first script. Moreover, the issue of missing mandatory components has been improved significantly as 34% of participating students who made these mistakes did not make the mistakes after the first time they use the tool.

References

Demorest, A. P., & Alexander, I. E. (1992). Affective scripts as organizers of personal experience. *Journal of Personality*, *60*(3), 645-663.

Gutierrez, P. (2014). *The Power of Scriptwriting!: Teaching Essential Writing Skills Through Podcasts, Graphic Novels, Movies, and More*. Teachers College Press.

Khalili, S. (2018). Analysing the advantages of Aristotle's two-act structure in comparison with Syd Field's three-act structure in short comedic animation scriptwriting. *Journal of Screenwriting*, *9*(3), 265-277.

Kinnunen, T., Leisma, H., Machunik, M., Kakkonen, T., & Lebrun, J. L. (2012, April). *SWAN-scientific writing AssistaNt. a tool for helping scholars to write reader-friendly manuscripts*. The The 13th Conference of the European Chapter of the Association for Computational Linguistics (EACL 2012), Avignon, France.

Ladopoulou, G., & Dimitriadis, G. (2022). *The Female Perspective: Stereotypes Vs. Realism in Film Character Portrayal and Development* [Diploma Thesis, Aristotle University of Thessaloniki]. IKEE / Aristotle University of Thessaloniki – Library.

Marx, C. (2021). *Writing for animation, comics, and games*. CRC Press. https://www.sciencedirect.com/book/9780240805825/writing-for-animation-comics-and-games

Na Chai, W., Ruangrajitpakorn, T., & Supnithi, T. (2017, December 4-8). *A Tool for data acquisition of thinking processes through writing*. The 25th International Conference on Computers in Education (ICCE 2017), Christchurch, New Zealand.

Na Chai, W., Ruangrajitpakorn, T., & Supnithi, T. (2019, December 2-6). *A Tool for Learning of Cognitive Process by Analysis from Exemplar Documents*. The 27th International Conference on Computers in Education (ICCE 2019), Kenting, Taiwan.

Jaiboonlue, P., & Na Chai, W. (2023). A Design of an Ontology for Animation Scripts Writing Towards the Learning of Necessary Elements and Relationship Among Them. *Journal of Information Science*, *41*(1), 66-85.

Redvall, E. N. (2009). Scriptwriting as a creative, collaborative learning process of problem finding and problem solving. *MedieKultur: Journal of media and communication research*, *25*(46), 34-55.

Scott, J. (2003). *How to write for animation*. The Overlook Press.

Takhom, A., Trakul Taweekoon, K., Chotimongkol, A., Porkaew, P., Na-Thalang, S. S., & Supnithi, T. (2011, November-December 28-2). *EAGLE: an Error tAGger for Learners of English*. The 19th International Conference on Computers in Education (ICCE 2011), Chiang Mai, Thailand.

WriterDuet. (2022, January 5). *Effortless Screenwriting*. WriterDuet. https://www.writerduet.com

Zhang, F., Hwa, R., Litman, D., & Hashemi, H. B. (2016, June 12-17). *Argrewrite: A web-based revision assistant for argumentative writings*. The 15th Annual Conference of the North American Chapter of the Association for Computational Linguistics (NAACL HLT 2016), San Diego California, USA.