



ISSN: 2617-6548

URL: www.ijirss.com



Challenges and opportunities of creating visual media content as output of project-based research in history classes: Perspectives of students of Nazarbayev intellectual School in Astana

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Abstract

The study aimed to analyze the effectiveness of the “conceptual-visual modeling” (CVM) method in creating visual historical media content as the output of project-based research of Middle Years Program students at the Nazarbayev Intellectual School in Astana. The study explores the perspectives of seven 10th graders who participated in the creation of visual historical media content. In this study, research data on the effectiveness of the CVM method and primary data from 182 NIS students on the challenges and opportunities of creating visual media content were collected through the approach of “mixed methods research,” whereby researchers analyze both quantitative and qualitative data using questionnaires, student personal reflections, and teacher observation. This approach allowed for a broad range of student perspectives and a comprehensive understanding of the challenges they face. Findings revealed that both “digital” and “non-digital conceptual-visual modeling” methods were suitable for creating visual historical media content. However, the “non-digital modeling” method was more effective. The reason for this decision was that most students believe that using the “non-digital (traditional) visual modeling” method, compared to the “digital visual modeling” method, provides the opportunity to fully convey the historical concept and the author's idea (message) to the reader (target audience). The following study's novelty lies in its focus on integrating the “CVM” method into pedagogy and demonstrating the advantages of the method for effectively engaging students in the creation of visual historical media content. The method was chosen and adapted to meet the requirements of a normally non-quantitative discipline, such as history.

Keywords: Conceptual-visual modelling, Historical media content creation, Media literacy skills, Product-oriented modeling, Student project-based research.

DOI: 10.53894/ijirss.v8i6.9601

Funding: This study received no specific financial support.

History: Received: 15 July 2025 / **Revised:** 18 August 2025 / **Accepted:** 20 August 2025 / **Published:** 1 September 2025

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Competing Interests: The authors declare that they have no competing interests.

Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.

Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Publisher: Innovative Research Publishing

1. Introduction

Conceptual-visual modeling is more commonly associated with subject areas such as design, software engineering, mathematics, and science education [1-8]. We decided to focus on an under-researched area, analyzing student perspectives on creating historical media content. We were interested in how Middle Years Program students would use the conceptual-visual modeling (CVM) method and what challenges they might face when applying the visual content creation process in history classes.

Most of the studies focus on the challenges and opportunities of student production of visual media content, such as video production and social media content like reels, posts, and stories [9-14]. However, another important type of media content that is equally significant is cartoons. This form of visual media, whether in digital or printed format, is part of the daily lives of thousands of people worldwide. Historical figures and events of global importance are brought to life through unique visualizations, making cartoons a vital educational and cultural tool.

Historical media content includes a wide range of materials designed to inform, educate, or entertain readers about past events and historical figures. These include films, historical books, archival footage, and photographs. The role of historical media is multifaceted, shaping how we perceive the past and how we view the future.

2. Literature Review

2.1. Search Strategy.

The strategy in searching literature plays a key role in providing a strong foundation for identifying and selecting studies, and ultimately for obtaining valid research results. First, a systematic literature review was conducted using international databases such as Google Scholar, Elsevier, ScienceDirect, PsycInfo, Scopus, and Web of Science. These databases were chosen because they cover a broad range of interdisciplinary research literature in the fields of education, student learning psychology, and social sciences. Second, the literature search was limited to studies written in English, Russian, and Kazakh. Therefore, regional research journals in Russian and Kazakh were also prioritized during manual journal searches. Next, the literature review was conducted through a “hybrid search strategy.” According to Wohlin et al. [15], a hybrid search strategy is a pre-selected and planned combination of two or more information retrieval methods during systematic literature searches. The effectiveness of the hybrid search strategy was investigated by Mourão et al. [16], who explored the integration of four different methods (2017). In our study, we utilized two searching methods: “database searching” and “backward snowballing”. As Greenhalgh and Peacock [17] in their study, they used three types of methods and found that the “snowballing” method was the most effective one for searching sources from specialized, however, least-known journals. Also, Gholizadeh et al. [18] highlighted that, database searching is important; however, it is necessary to apply “the snowballing” method to find additional papers from references. In our literature review, the “backward snowballing method” was used, as many researchers, such as Jalali and Wohlin [19], do not explicitly recommend “forward snowballing methods,” which involve searching for sources that cite the papers found in database searches. To ensure clarity and accuracy in the literature review, “The PRISMA method” was applied, derived from “The PRISMA 2020 statement” published by senior researcher Page [20], and the updates to the PRISMA guidelines were also utilized [21]. Consequently, inclusion and exclusion criteria were constructed: Inclusion criteria: (1) related to media content creation; (2) related to conceptual-visual modeling; (3) related to the education system; (4) related to students’ learning. Exclusion criteria: (1) do not meet the requirements of the inclusion criteria; (2) related only to primary or higher education institutions. The main aim was to extract empirical studies examining the challenges of the visual media content creation process and the opportunities of conceptual and visual modeling methods for students.

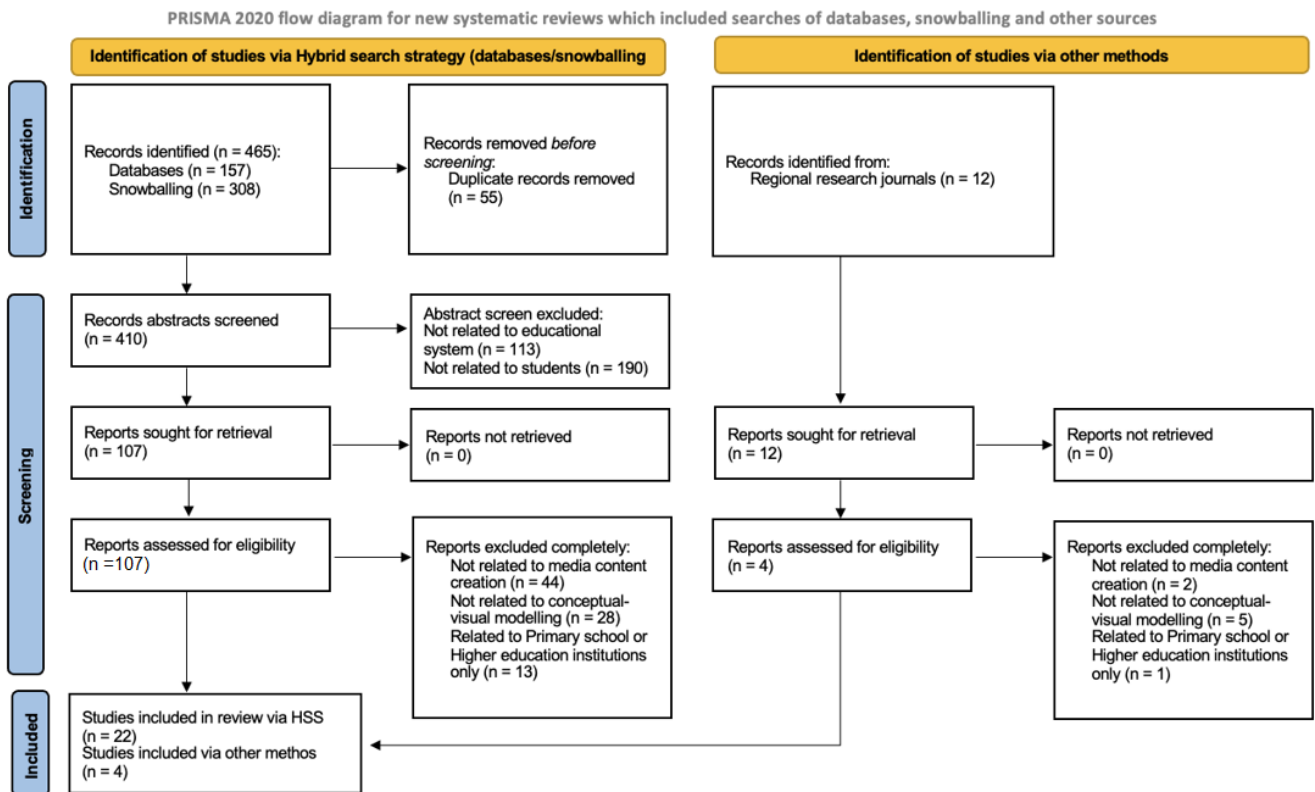


Figure 1.
The process of Systematic Literature Review via the PRISMA method.

2.2. Content Evaluation of Included Studies

Numerous academic studies have explored the challenges and opportunities of creating media content as an output of student project-based research activities focusing on various techniques of creative media content production. In addition, a significant number of articles and research papers have been published analyzing the effectiveness of conceptual and visual modeling methods in the process of turning a conceived concept into a prototype and from prototype design to final product creation. There are still a few studies evaluating the impact of the conceptual-visual modeling method on the development of students' project-based research skills in product-oriented teaching and learning processes. Thus, all existing literature on the research topic can be divided into two groups.

The first group examines the process of visual media content production by students. Al-Zoubi [10] investigated the process of creating videos, highlighting media literacy as a vital skill in education, particularly in fostering students' creative media content production skills. As one of the most recent scoping studies, Marini et al. [9] conducted research on developing a website integrated with project-based learning to stimulate creativity among elementary school students in Indonesia. Their study's practical implications recommend that educators incorporate website-based learning tools to develop creative thinking skills. Brown et al. [13] assess the opportunities of online media content creation (OCC) for student engagement and creativity, particularly focusing on African students as online content creators. Brown's research shows that the ability to create digital media products enables young learners to become competitive. Rooney-Varga et al. [8] explored how to deploy students' products as tools for actively and socially engaging with media content about climate change to increase motivation and promote greater understanding of the climate change issue, with the help of students to inform a large community. They divided the media content creation process into three phases: pre-production stage, production stage, and post-production stage. Rooney-Varga, Brisk, and other researchers of the University of Massachusetts observed an incredible level of engagement and involvement in the project, as well as a sense of freedom of choice and opportunity through qualitative analysis of student experiences [8]. A deep study was conducted by Snelson [14] a researcher from Boise State University, who explored producing videos in subject pedagogy. Snelson's research mainly involved the creation of student videos, using YouTube channels for educational purposes. In her research, she conducted a review of the academic studies on creating videos, which provides students the opportunity to gain subject matter knowledge while developing technological skills. One of the most relevant and recent studies related to the research question is Nuzulia et al. [12]. The text emphasizes the exploration of the opinions of student-producers regarding the challenges and opportunities encountered during the process of producing digital media content as a result of product-oriented research work. Nuzulia's research data were collected from Maritime University students, who were studying the language. English language learners participated in creating digital media products with a marine theme as part of a collaborative vocabulary development project. In this research, they identified challenges such as vocabulary limitations, gaps in communication skills, and self-organization skills. Regarding the extensive works written much earlier on this research topic, a book by Kindem and Musburger [22], consisting of several editions, has been published for students who

want to learn how to professionally and systematically shoot media content or are interested in that profession. The fourth edition of "Introduction to Digital Media" provides a comprehensive guide for both media students and newcomers to the media industry, covering film, TV, video, audio, and graphics. Most studies in this category predominantly concentrate on the challenges and opportunities of student production of visual media content, such as video production and social media content like reels, posts, and stories. One of the equally important types of media content is cartoons. This type of visual media content plays a significant role in the lives of thousands of people around the world. However, there remains a gap in emphasizing the significant role of creating visual media content such as cartoons, especially in teaching and learning in history classes, to enhance media-information literacy, creativity, and transfer skills.

The second group explores the effectiveness of conceptual and visual modeling methods in various fields. The author of the international bestseller "The Back of the Napkin," one of the well-known books on visual thinking, is Roam [23]. He founded Digital Roam Inc., a consulting company that applies visual thinking to problem-solving. Roam [24] the art of visual thinking and presentation can be used as an effective and creative approach that could be very useful to master for students, who are newcomers and even for experts in media content production. He claims that, if students have an idea to pitch, they need to conceptualize and visualize through visual-thinking models. His visual thinking method is designed to help readers think and learn faster, motivate students, and inspire and share knowledge in a completely different way. He also wrote other works (2011), focusing on presentation without words and a book titled [7], where he provides guided examples, providing evidence that everyone would use this technique as visual thinking, not just left-brain dominant people who do not like drawing, but even right-brain dominant people who dislike the writing process. One of the most recent studies related to this method was conducted by Tusquellas, López-Villanueva, Palau, & Santiago, 2025 whose work presents the development of educational conceptual models an innovative approach to using technology in pedagogy. This study by Tusquellas, López-Villanueva, Palau, & Santiago 2025, researchers at the University of Rovira i Virgili, focused on the stages of conceptualizing, the modeling process, and the inclusion of knowledge. Bozlu and Demirörs [6] explored a methodology of concept-based modeling from conceptual model to design, where they provided several explanations on how simulation design can be developed by using conceptual models. Wang et al. [3] explored concept-based modeling as the first stage of the hydrological model creation process. In their study, it was highlighted that the conceptual-visual scenario is the result of hydrological concept-based modeling. Guseinova [1] in her study considered the opportunities of the visual modeling for the educational system. According to Guseinova [1], to create a model, it is necessary to have an understanding of the entire structure of the object under study or the elements that comprise this structure. The model visualizes the goals and components of the product, showing their interrelationships and identifying methods of problem resolution. Fumagalli et al. [2] in their research approach correctly applied the results obtained using the conceptual-visual modeling. Rosenthal et al. [25] explored the process of conceptual modeling itself and the difficulties that students encounter when modeling. According to Rosenthal and other researchers at the University of Hagen in Germany, conceptual-visual modeling is an important learning activity for students studying computer science as well as software engineering. They identified modeling challenges that allow for deeper insight into the modeling processes of more complex content that inform the research problem. The most relevant exploratory study in this category concentrated on the application of "Three D modeling" by educators and learners as part of project-based research in history classes, as published by Maloy et al. [5]. As a result of Maloy's exploration, it was found that educators and users initially perceived this method as a difficult visual modeling technique for visualizing history-related content. Additionally, Amherst Regional Middle School students found that modeling projects were highly engaging and could serve as an effective approach to demonstrate complex ideas related to historical events. Furthermore, some researchers and educators revised their perspectives regarding the application of "Three D modeling" methods and the visual modeling of historical concepts in classrooms.

However, recent studies show that there is still a gap in emphasizing the important role of the "conceptual-visual modeling" method in pedagogy, particularly in creating visual media content in the context of history subjects by secondary school students.

3. Methodology

There are many ways to conduct research, and many methods can be used for gathering data on the challenges of creating visual media content in history classes and the opportunities of using the conceptual-visual modeling (CVM) method in different stages of the student project.

3.1. Participants in the Study

Nazarbayev Intellectual School in Astana was the research scope of this study. In this study, 182 students, who were involved in creating visual historical media content via the conceptual-visual modeling method, participated as respondents to gather the opinions of students and a comprehensive understanding of the challenges they face.

3.2. Data Collection

Our study focuses on the application of a mixed methods approach [26], which combines both quantitative and qualitative research methods within a single study or across multiple related studies [27]. We conducted this study as an exploratory qualitative study (interview) involving the perspectives of 182 visual media content creators (Grade 10 students), which was later complemented with a follow-up study using a quantitative method in the form of a post-

production questionnaire [28] and a qualitative method in the form of post-production "individual student evaluations" [29]. This approach allows us to confirm and extend the data obtained from the quantitative study [4]. Venkatesh et al. [30] recommend drawing meta-inferences after data collection, which are insights gained from combining the results of both quantitative and qualitative studies at the end of the data collection process [31]. Therefore, our methodology for data collection is based on students' perspectives regarding the effectiveness of CVM methods and the challenges they faced during visual historical media content production. Ultimately, we first examined the original exploratory qualitative data and then applied these findings to design a subsequent quantitative study.

3.2.1. Exploratory Qualitative Methods: Group Interviews and Individual Student Evaluations

The study was conducted with the approval of the Nazarbayev Intellectual School in Astana. Respondents participated in the study voluntarily, and no incentives were offered to study participants. Students were only given the opportunity to participate in the research. Once our necessary permissions were obtained, the researchers conducted an exploratory qualitative study via pre-producing unstructured interviews with the future participants to gather initial information [32]. The responses were then grouped into themes and explored to develop a post-production questionnaire as a quantitative phase. After completing the project on visual historical media content production, it was organized as an exploratory qualitative study, where every participant was required to complete the post-producing "individual student evaluation" [29] of the process, results, and methods used based on open-ended questions.

3.2.2. Quantitative method: questionnaire

Quantitative research design is a systematic and objective method for investigating phenomena. In this study, a post-producing questionnaire was used as a quantitative method to collect numerical data on the degree of challenges faced by students and the effectiveness of the CVM method in creating political caricatures as output of project-based research conducted at NIS in Astana, Kazakhstan, during the 2024-2025 academic year.

3.3. Data Analysis

The researcher used a weighted mean calculation for the analysis of the data collected from post-production questionnaires distributed to student-respondents. This approach allowed us to summarize the gathered data and understand the participants' perspectives regarding the issues and challenges in creating media content. A five-point Likert scale [33] was used to measure the degree of difficulty students face in creating visual historical media content such as political caricatures. Table 1 presents the details of the scale used in measuring the degree of challenges.

Table 1.
Description of the Likert scale in measuring the degree of challenges in visual historical media content production.

Degree of difficulty	Point distribution scale	Descriptive equivalent
4	3.51 - 4.00	Very Difficult
3	2.51 - 3.50	Difficult
2	1.51 - 2.50	Moderately Difficult
1	0.51 - 1.50	Slightly difficult
0	0.00-0.50	Not difficult At All

Additionally, the extent of the effectiveness of applying conceptual-visual modeling methods in creating visual historical media content (political caricatures) was assessed using the same five-point Likert scales. Table 2 presents the details of the scale used in measuring the degree of effectiveness of the CVM method.

Table 2.
Description of the Likert scale in measuring the degree of effectiveness of CVM.

Degree of Effectiveness	Point distribution scale	Descriptive equivalent
4	3.51 - 4.00	Very Effective
3	2.51 - 3.50	Effective
2	1.51 - 2.50	Moderately Effective
1	0.51 - 1.50	Slightly Effective
0	0.00-0.50	Not Effective At All

As for analyzing data collected from the Exploratory Qualitative Study, where every participant completed the post-producing "individual student evaluation" [29], students were required to evaluate the process and the results of the project-based research based on the following open-ended questions: (1) Reflect on which CVM method was the most effective and why; (2) Reflect on whether it was difficult to convey the historical conceptual idea visually; (3) Reflect on which cartoons were the most powerful and why; (4) Reflect on the other challenges in creating political cartoons as visual historical media content; (5) Reflect on ways to improve the weak sides of your product and your suggestions for teachers on how to address these issues.

4. Results and Discussion

A quantitative study's results indicated that the majority of students showed great interest in creating political caricatures as visual historical media content in the context of World War Two, highlighting issues and challenges they faced. The two most critical issues were lack of skills in digital concept-based visual modelling, with a weighted mean of 3.61 (Very difficult), and weaknesses in using AI-generated CVM methods for historical visual content creation, with a weighted mean of 2.72 (Difficult). Table 3 presents data on the challenges faced by the respondent-students in creating visual historical media content.

Table 3.

The challenges faced by the respondent-students in creating visual historical media content.

Degree of difficulty	Point distribution scale	Descriptive equivalent
1) Hand Drawing (Non-digital traditional method of creating caricatures)	1.16	Slightly Difficult
2) Digital Drawing (Using graphic tablets and programs)	3.61	Very Difficult
3) Generating with AI (Using AI to give a text prompt)	2.72	Difficult
4) Manual Collage (Cutting and pasting parts of photos, headlines)	0.32	Not difficult at all

As a result of the post-producing questionnaire, it was revealed that using product-oriented "Conceptual-Visual Modeling" methods in all stages of the research project was effective, with a weighted mean of 3.32 on average. For instance, in the formulation of the "Research Question" and "Justification" (Stage 1), in creating the "Action Plan" (Stage 2), in drafting the "Sketch Model" (Stage 3), and in creating a "Final Product" (Stage 4), the application of the CVM method was also rated as effective and very effective, with weighted means of 2.29, 3.45, 3.87, and 3.37 respectively. Table 4 presents data on the effectiveness of the CVM method in different stages of the project.

Table 4.

Description of the Likert scale in measuring the degree of effectiveness of CVM.

Degree of Effectiveness	Point distribution scale	Descriptive equivalent
Stage 1. Formulation of the Research Question and Justification	2.29	Moderately Effective
Stage 2. Creating the Action Plan	3.45	Effective
Stage 3. Drafting the Sketch Model	3.87	Very Effective
Stage 4. Creating a Final Product	3.37	Effective

Discussing the results of the exploratory qualitative study, where every participant completed the post-project "individual student evaluation" of the process and results of the project and method used based on open-ended questions [29], it was identified that both "digital" and "non-digital conceptual-visual modeling" methods were suitable for creating visual historical media content. However, the "non-digital modeling" method was more effective. The reason for this decision was that most students believe that using the "non-digital (traditional) visual modeling" method, compared to the "digital visual modeling" method, provides the opportunity to fully convey the historical concept and the author's idea and message to the reader or target audience.

Discussing other results related to the process of a product-oriented research project, 182 students of Grade 10 were involved in a long-term project-based research on creating visual media content "Political Caricatures" conducted in the context of Unit 4 "The Second World War". In every class, there were 12-14 students, and the class was divided into 4 groups, where each group was given a choice to select a topic for investigation based on their interest from the following list: 1. Invasion of France; 2. Battle of Britain; 3. Invasion of the USSR; 4. War in Asia. Based on the MYP program of IB [34], visual product creators were required to connect their research questions with key concepts and history-related concepts. In this project, historical media content creators applied all of the MYP approaches to learning, primarily enhancing their media literacy skills, creative thinking skills, and transfer skills. In the following unit, there was one key concept (ideology) and two subject-related concepts (cooperation, conflict). As a part of the IB program [35] and based on Boix-Mansilla's [36] work the statement of inquiry of the unit was provided ("The breakdown of global cooperation due to opposing systems based on conflicting ideologies can lead to greater conflicts"), and students were effectively using the CVM method to integrate concepts into their research question for the project.

In Stage 1 (Lesson #1 of 60 min.) students were required to complete the following tasks: (1) Review all criteria level descriptions and mark specifications; (2) Choose one topic for the investigation; (3) Create a clear and focused research question using CVM method; (4) Choose different types (at least two different types) of cartoons from the table below, see Table 5; (5) Choose different Conceptual-visual modeling (CVM) methods (at least two different types) to create cartoons from the table below, see Table 6.

Table 5.
Types of political cartoons.

Type	Description	Purpose/Effect
Symbolic	Using symbols to represent countries, ideologies, or concepts (e.g., animals, objects, flags).	To simplify complex ideas and make a visual impact.
Juxtaposition	Contrasting two opposing ideas, actions, or individuals to create humor or critique.	To show hypocrisy, inconsistency, or contradiction.
Propaganda	Promoting a particular political agenda or viewpoint, often one-sided.	To persuade or rally support/opposition.
Forecast / Warning	Suggesting future outcomes if current trends continue.	To raise awareness or create a sense of urgency.

Table 6.
Conceptual-visual modeling (CVM) methods for creating political cartoons.

Method	Description
Hand Drawing (Non-digital traditional modeling)	Using pencil, pen, marker, or ink - the classic method.
Digital Drawing (digital modeling)	Using graphic tablets and programs like Adobe Illustrator, Photoshop.
Generating with AI (concept-based visual modeling via AI)	Using IA to generate a caricature from a text prompt.
Manual Collage (traditional visual modeling via artwork)	Cutting and pasting parts of photos, headlines, or drawings manually.

In Stage 2 (Lesson #2 of 60 min.), students were required to complete the following tasks: (1) create and follow the Action Plan using the CVM method; (2) collect and record relevant information using different research methods (at least two different types).

In Stage 3 (Lesson #3 of 60 min.), students were required to draft a “Sketch Model” of the product using the CVM method on paper or digitally: (1) Visual modeling, indicating where the text or caption will go; (2) Conceptual modeling, highlighting which details are important to include in the draft message of the cartoon. The concept-based visual modeling method is used for drafting sketches of a final product. Data collected from the questionnaire shows that, of all the stages of the research project, the CVM method was recognized as the most effective at this stage 3 (Drafting the Sketch Model), with the highest weighting of 3.87 (Table 4).

In Stage 4 (Lesson #4 of 60 min.), students were required to complete the following tasks to create the final product (Political Caricatures): (1) Use different types of cartoons (at least two different types); (2) Use different CVM methods to create cartoons (at least two different visual modeling methods); (3) Add a caption, meme-style text, or headline; (4) Write the message of the cartoon. Based on Table 3, the non-digital traditional CVM method was identified as slightly difficult, with a weighted mean of 1.16. It was revealed that although all students know how to draw, some students' hand-drawing skills still need to be improved in order to fully convey historical conceptual ideas and the emotions of historical figures. Because in this kind of visual product-oriented project, students need to apply transfer skills as well. However, qualitative data collection via students' individual evaluations shows that the most effective method was not the digital CVM method, but the non-digital traditional CVM method. One of the students wrote in the evaluation: It was challenging to convey the ideas we wanted to present in the form of visual media content as cartoons, because of this we also had multiple discussions about how it would be more effective to present a complex conceptual idea related to our research question. However, we still succeeded in creating the final product in three different styles: propaganda, symbolism (lion = Britain and dog = Germany), and juxtaposition, because concept-based visual modeling techniques allowed us to plan, draft, and create our ideas.

Synthesizing results of the study gathered from qualitative data collection via “Students' individual evaluations” and quantitative study via “questionnaire” related to the process and the results of the project, although the collage technique is easy to use and very effective for visual thinking, this method does not fully reveal the author's idea when creating a visual model of historical content.

As a result of qualitative data collection via “Students' individual evaluations” and quantitative study via “questionnaire” related to the process and the results of the project, it was concluded that although artificial intelligence can produce high-quality images, this conceptual-visual modeling method is very weak in conveying the historical concept and the author's idea.

Analyzing data from a quantitative study as a “post-producing questionnaire,” it was revealed that “Digital concept-based visual modelling,” with a weighted mean of 3.61, was considered very difficult and challenging for students. This is because, although most students have tried digital drawing devices such as graphic tablets and programs, some of them have not yet mastered this digital conceptual-modeling technique properly. Moreover, if we explore collected data from “Students' individual evaluations,” students conclude that this digital modelling method is completely ineffective in conveying the author's idea based on a deep historical concept.

5. Conclusion

As a result of this year-long action research and in-depth study, we have come to the following conclusions and recommendations: (1) it is concluded that students' media content creating projects in history classrooms can be used as a very effective approach to the teaching and learning process and in improving not only their historical knowledge but also their media literacy skills, transfer skills, creative thinking skills, and most importantly, their project-based research skills. We, as teachers and researchers of this process, were truly impressed by what students created and how they provided in-depth evaluations of the process as visual historical media content creators; (2) based on findings from the mixed-method study, it was also concluded that the application of the traditional CVM method in the teaching and learning process was effective for visualizing complex historical concepts and ideas; (3) Synthesizing the feedback students provided through various methods regarding their challenges in creating visual media content, we suggest that further research is needed to help students effectively use digital conceptual-visual modeling methods and the various digital programs required for it in history lessons.

Through project-based research, students can inquire about complex historical systems through "Learning by Creating." The political cartoons created using different CVM methods serve as the core of this knowledge. Visual historical media content production via conceptual-visual modeling today can create new innovative approaches to teaching and learning history.

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