Transformational Understanding of Causal Relation of Historical Events in Historical Learning Based on State Transition

Tokutake Keitaro
Tokyo Institute of Technology
tokutake.k.aa@m.titech.ac.jp

Kojiri Tomoko
Kansai University
kojiri@kansai-u.ac.jp

Uratuji Daichi
Kansai University
k612309@kansai-u.ac.jp

Murota Masao
Tokyo Institute of Technology
murota@ila.titech.ac.jp

Abstract: The Japanese Ministry of Education, Culture, Sports, Science and Technology prioritizes subjective learning in its curriculum guidelines. As a goal for learning in the field of history, the Ministry emphasizes the importance of training students in the ability to consider historical events as multifaceted and to fairly select and judge historical issues. In order to foster these abilities, teachers must encourage students not only to understand historical events, but to also consider the causal relationships between events. Nate(2016) developed a learning support system that promotes students' understanding of causal relationships by encouraging them to consider changes in the states of people and objects in historical events. The purpose of this study is to improve this system and understand whether employing the system among students changes their understandings of causal relationships amongst historical events.

Keywords: Historical learning, Structuring knowledge, Causal relationship, State chang

INTRODUCTION

The general provisions of the Ministry of Education, Culture, Sports, Science and Technology(2017) call for the improvement of lessons in order to provide students with active, interactive, and deep learning. The guidelines set the goal for historical learning in junior high school as training students in the ability to understanding the multifaceted meaning and significance of historical events focusing on transitions, comparisons, and mutual relationships as well as teaching students to select and judge historical issues seen fairly.

In order to foster students' abilities to select and judge historical subjects fairly with an awareness of their own subjectivity, it is necessary to teach them about the relationships between complex social phenomena. Shemilt(1983) asserts that students' understanding of the causal relationship between historical events is changing from linear to structural understanding. However, Yui(2011) points out that in traditional historical learning in Japan, teachers explain the time sequences of historical events, but there is not sufficient support for students to think about causal relationships structurally.

In order to help students acquire structural thinking, it is not enough for teachers to educate students about the structure of historical events. Instead, it is necessary for students themselves to develop perspectives from which they can structurally understand the causal relations between historical events. If students acquire the ability to structurally arrange and understand causal relationships between events, teachers will be able to help students learn how to consider historical events subjectively.

VISUALIZATION OF KNOWLEDGE STRUCTURE

Knowledge structure visualization techniques have been developed to encourage students to understand the structure of learning contents, such as Novak's conceptual map method(1990) and Sato's ISM(Interpretive Structural Modeling) structure chart(1987). These techniques help learners organize and evaluate their own knowledge structures by using educational materials that show the contents of the events to visualize the related structure. Teachers are also able to evaluate student's knowledge structures using these techniques. However, studies evaluating structural diagrams drawn using these visualization techniques show that teachers only provide students with true or false information about causal relationships between historical events. This indicates that there is insufficient support for students to acquire viewpoints from which to understand the causal relationships among historical events.

In order for students to understand the causal relationship between events structurally, it is necessary to discuss the ways in which society changed as a result of the event. Nate(2016) proposed a learning method to help students understand the causal relationships between historical events structurally by considering how people or objects have changed through historical events. In this study, changes in people or objects are referred to as "state changes." Nate also proposes that students should make a causal relationship diagram after creating a state changes map so that they become conscious of state changes.

Nate(2016) used the ISM structure chart as a visualization method to organize the causal relations among historical events. Historical learning requires students to consider historical sequences. The ISM structure chart is a hierarchical graph, while Novak's conceptual map method does not show historical sequences. For this reason, Nate(2016) judges that the ISM structure chart is effective in improving history learning. Figure 1 shows an example of a causal relationship diagram created using an ISM structure chart. This example concerns the formation of a group of samurai and the interior fighting of the Emperor that were triggered by the Heiji Rebellion.

A person or an object involved in a historical event is placed on the vertical axis of the state change map, while an event arranged along the historical sequence is placed on the horizontal axis. The state of the person or thing changed under the influence of the historical event is input in this table. Through this process, students organize information about events, people, and state changes. Figure 2 shows an example of a state change map. Through this method, Nate (2016) encourages students to draw a causal relation diagram after thinking about the state change of the persons and objects in each event. Figure 3 shows an example of a causal relationship diagram with the state change of a person or object. In this example, it is indicated that the Battle of Dan-no-ura occurred due to the dissatisfaction of samurai in the eastern area as a result of the Heiji Rebellion.

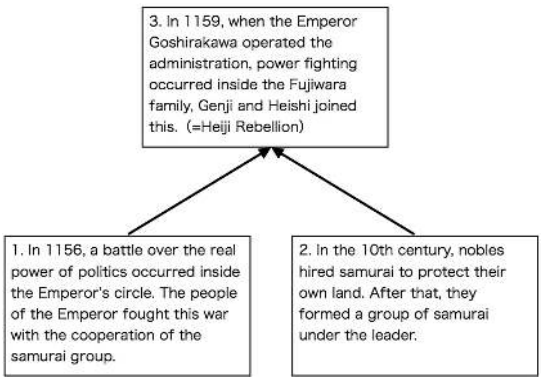

Figure 1 Example of ISM structure chart

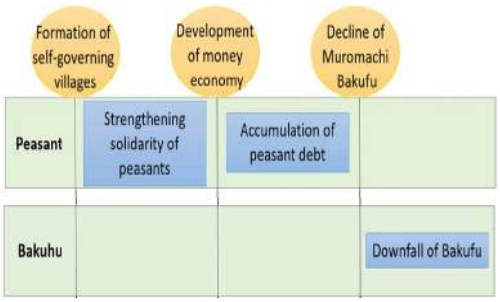

Figure 2 State change map

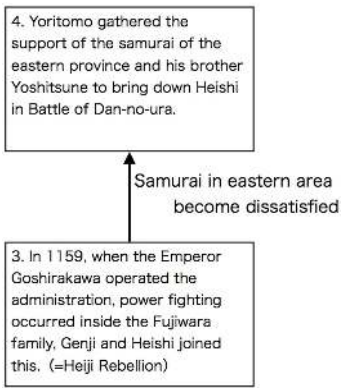

Figure 3 Example of a causal relationship diagram with a state change

THE PURPOSE OF THIS RESEARCH

In this study, we develop a learning support system that fosters the understanding of causal relationships by relating the state changes of people to historical events and thereby improving students' understanding of causal relationships. We also examine the changes in students' understanding of causal relationships between historical events that come about when the system developed in this study is used.

In order to achieve the above purpose, with reference to the evaluation index of the ISM structure chart indicated by Kato(1988), students' causal relation diagrams were evaluated using the following two points.

・Point1: Common lines with the teacher's diagram (Common line)

・Point2: Extra lines drawn compared to the teacher's diagram (Extra line)

If it is possible to achieve the above purpose, the significance of this study is in realizing students' subjective historical learning.

UNDERSTANDING THE SUPPORT SYSTEM FOR CAUSAL RELATIONSHIPS IN THIS STUDY

Nate(2016) helps students understand causal relationships between historical events by arranging state changes that occur as a result of each event.

However, in order to understand the causal relationships between events, it is not enough to understand the state changes that occur as a result of each event. In this study, we determine the state changes that trigger each event. We thought that students' understanding of events was better promoted when the causal relations between historical events could be captured structurally. Therefore, in this study, we developed a support system for understanding causal relationships with which students arrange state changes occurring before and after each event and then draw a causal relationship diagram. In the system we developed, the state of a person or thing is represented by a block of color on a card. Person or object states are entered in the form "(person)/ (state)/(value：high or low)" in the system. Figure 4 shows an example of a state change input screen. Each state has its own color set, and students label the type of state changes using different colors. As shown in Figure 5, the state change that triggered the event is written on the lower part of the card that contains the contents of the event. Also, on the top of the card, students enter the state change that occurs as a result of the event. The Battle of Dan-no-ura can be taken as an example; this battle was a dispute that occurred as a result of the growing discontent of the Emperor and the samurai of the eastern area. Heishi was destroyed in this battle. The state change in this historical event is entered as follows.

・State change that triggered the event： "Emperor (person)/dissatisfaction (state)/UP (value)"

・State change resulting from the event： "Samurai of eastern area (person)/dissatisfaction (state)/UP(value)"

Figure 6 shows the card after all the state changes of each event are input. In the system developed in this study, it is possible to connect the lines only when the state change resulting from the event and the state change causing the event coincide. For example, both the state change resulting from the War of Heiji and the state change that triggered the Battle of Dan-no-ura were entered as "Samurai of eastern area (person)/dissatisfaction (state)/UP (value)" . In this case, we can draw a line between the two events.

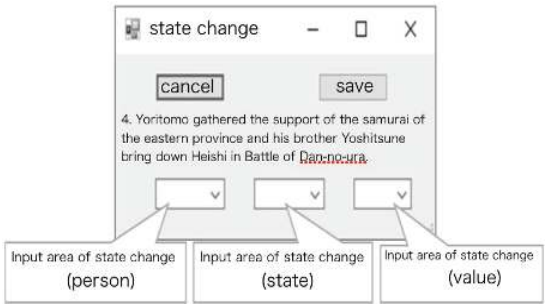

Figure 4 Example of state change input screen

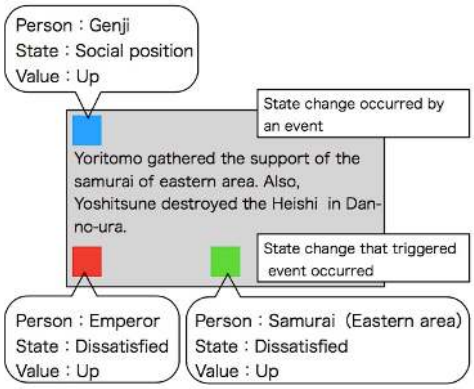

Figure 5 A card with a state change input

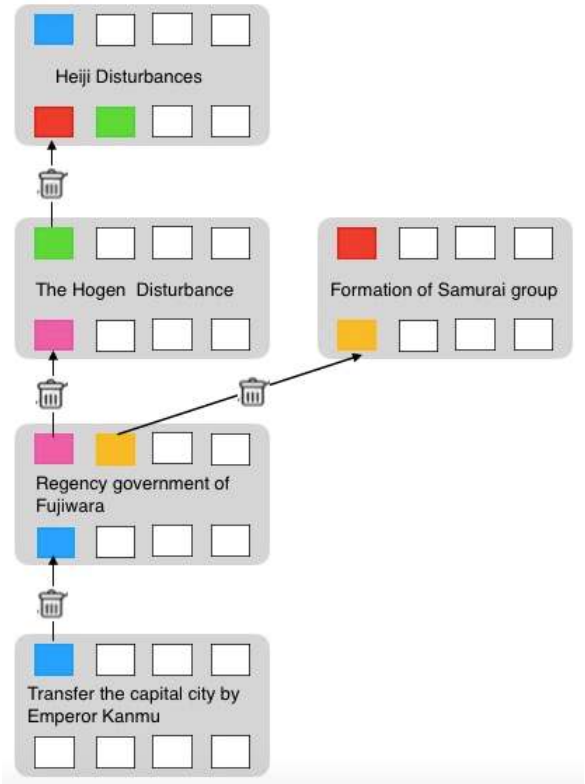

Figure 6 A card with all state changes entered

SURVEY TARGET AND PRACTICAL PERIOD

The subjects of the survey were 27 second-grade students in a private junior high school in Tokyo. The investigation period was between April and May 2017. The students had been taking lessons using causality maps since April, and fully understood the method of drawing such maps. The textbook used was Tokyo Shoseki's "New History."

LESSON CONTENTS AND CREATION OF HISTORICAL EVENT CARD

We conducted classes in which causal relation diagrams were made using state change for the above survey target. The unit title was "Japan in the Heian

period." In the classes, we covered the political and cultural backgrounds from "Politics of Emperor Kanmu" to "Destruction of Heishi." I did not discuss the relationship between the events because I wanted the students to consider the causal relationship between each event. Table 1 shows a summary of the class contents taught in this unit. Each of the ten class contents was used as an element of a causal relation diagram. The cards showing the elements were presented in a random order so that students would not be able to guess the causal relations from the position of the cards. The contents of the lesson and the elements used in the causal relation diagram were prepared by three teachers specializing in the history field of social studies, including the author. In lessons using the previous structural diagram, the students connected lines indicating time sequence and mutual relations; during this study, I instructed students to draw lines only for causal relationships. In addition, the state change in this research was prepared with the assistance of three school teachers. The contents are shown in Table 2.

Table 1 Summary of contents used in causality diagram

Category	**Contents**
Politics of the Emperor and Nobility	Transfer the capital city by Emperor Kanmu
	Regency government of Fujiwara
The culture of the Heian period	Faith of esoteric Buddhism
	Formation of native Japanese culture
	Faith of the jodo sect
Establishment and expansion of Samurai	Formation of Samurai group
	The Hogen Disturbance
	Heiji Disturbances
The ups and downs of Heishi	Domination of West Japan by Heike
	The Heike fell in Dan-no-ura.

Table 2 State change used in this research

Person	**State**	**Value**
・Emperor ・A nobleman ・Fujiwara ・Samurai ・Buddhist ・Samurai of Eastern area ・Samurai of Western area ・Genji ・Heishi	・Social status ・Authority ・Financial strength ・Dissatisfied	・Up ・Down

EVALUATION OF CAUSAL RELATIONSHIP MAP

At the end of the lesson, students were asked to create causal relationship maps similar to those they normally used. Causal relationship maps were created by individuals using the print materials, textbooks, and historical materials used for classes. After creating the causal relationship maps, we created maps based on state changes again. To evaluate the students' causal relationship diagrams, we calculated the two points "common line" and "extra line" with the causal relation map drawn by the teacher using Kato's method(1988). There were fifteen connections drawn by the teacher. Figure 7 shows the causal relationship diagram drawn by the teacher.

We examined how the common connections with the teacher changed before and after the use of state change maps. The average number of common lines before using state change was 4.29, on average. The average number of common lines after using state change was 4.77. A t-test was conducted on these results, and it was found that there was no significant difference before and after the use of the state change($t(26)=1.258, p>0.5$). However, among the 27 students, the common lines of 13 persons increased, and the common lines of 6 persons decreased. In addition, among the 13 people whose common lines increased, 12 had less than average common lines before using state change. Also, among the 6 people whose common lines were reduced, 5 had more than average common lines before using state change.

For this reason, we conducted a t-test for 21 people, removing the 6 whose common lines had been reduced before and after using the state change. As a result, it became clear that the number of common lines significantly improved after state change use ($t(20)=4.374, p<0.1$). Also, there was no significant difference in extra lines in either case. Table 3 shows the before and after mean, standard deviation and t-test result. For this reason, it is considered that state change is effective as a method for supporting the understanding of the causal relations among historical events for students who find it difficult to create a causal relation map. However, for students who understand the causal relationship of events, specifying the condition of state change may restrict their understanding of causality.

In order to evaluate the transformation of students' understanding of causal relationships in more detail, element cards were classified into four types according to their contents. The categories of classification are shown in Table 1. In addition, we

evaluated lines that connected with elements of the same category and lines that connected with elements of another category separately. There were 6 lines drawn by the teacher in the causal relation diagram for the same category and 9 lines for different categories.

For the 21people mentioned above, variance analysis was performed to verify the effects of learning using state change. For the common lines for the same category, we set the first level before state change use. In addition, we set the second level after using state change. For the same categories of lines, we analyzed variance in the same way. The extra lines were also divided into lines for the same category and lines for other categories, and the same analysis was performed.

Table 4 shows the average and standard deviation of the number of correct answers before and after the state change for the common lines drawn by the students.

Table 5 shows the average and standard deviation of extra lines.

Result of our analysis showed that the number of correct answers to the line for the same category of common lines were significantly improved ($F(1, 20) = 5.75$, $p < .05$). Funada(2012), who studies methods of teaching causal relationships among historical events, sees the variables for understanding the relationship between events as a method for improving students' understanding of the causal relations among historical events. Shemilt(1983) claims that students with a better understanding of historical events view causality not only as a concrete event, but also as a more theoretical, or abstract, event. From this perspective, it is considered that state change as used in this research was a more abstracted historical event and worked as a parameter to capture the causal relationships between events.

In addition, the number of correct answers was also significantly improved for connections to other categories of common lines ($F(1, 20) = 15.76$, $p < .01$). Voss and Carretero(2000) say that when students understand historical events, they often do not understand that there is a relationship between political, economic, and cultural aspects. The learning method proposed in this study is able to help students understand such phenomena by abstracting the event. For this reason, we think that the understanding of the causal relation to another category event that is difficult to capture is improved using our method.

On the other hand, in this study there was no significant difference in extra lines. Brophy et al. (1992) states that when thinking about the causal relationship between events, it is necessary to think about the possibilities of time. With this point in mind, it is considered that state change used in this research was not appropriate as a method to think about the possibilities of the era.

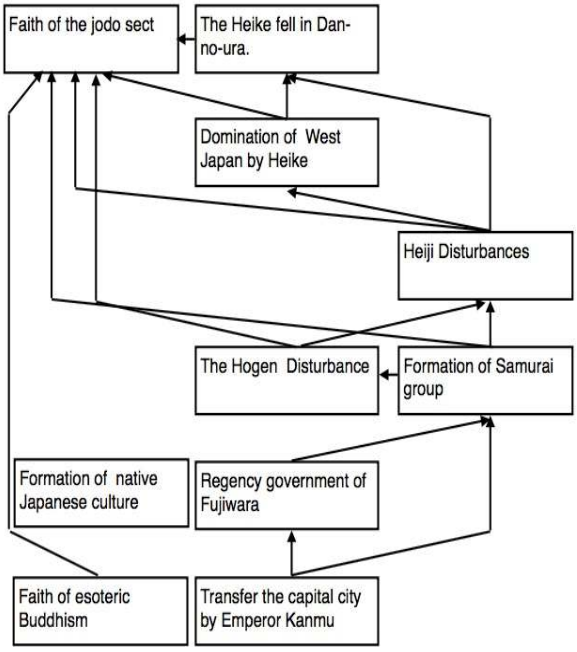

Figure 7 Causal relationship map drawn by a teacher

Table 3 Before and after mean, standard deviation and t-test result.

Before/After	Before		After		
	M	S.D.	M	S.D.	t-value
Common lines(N=27)	4.296	1.856	4.777	1.310	1.255
Common lines(N=21)	3.714	1.553	5	1.311	4.374**
Extra lines(N=27)	1.740	1.953	1.518	1.311	0.592
Extra lines(N=21)	1.238	1.300	1.238	0.995	0

*p<.05, **p<.01

Table 4 Average and standard deviation of the number of correct answers for common lines

Line Type	Common Line of Identicial Categories		Common Line of Another Categories	
Before/ After	Before	After	Before	After
N	21	21	21	21
Mean	1.952	2.333	1.761	2.666
S.D.	0.95	0.835	1.305	1.083

Table 5 Average and standard deviation of extra lines

Line Type	Extra Line of Identicial Categories		Extra Line of Another Categories	
Before/ After	Before	After	Before	After
N	21	21	21	21
Mean	0.238	0.381	1.047	0.851
S.D.	0.526	0.485	1.09	0.833

FUTURE TASKS

In this study, we proposed a learning method to support students' understanding of causal relationships between historical events. We also examined whether students' understanding of the causal relations between historical events is affected by the use of state changes. As a result of encouraging students to develop the concept of state changes and evaluating their development, it became clear that state change is a variable that allows students to understand the causal relationship between events. For this reason, it is suggested that state change may be effective for improving students' understanding of the causal relationships between events.

On the other hand, it became clear that it is difficult to think about the possibilities in time between events simply by creating a causal relationship diagram that takes state changes into account. The following two points should be considered in future research on this subject.

1: Consider a method of support for students at the level where no effect was seen.

2: Consider a method of support to reduce extra lines.

REFERENCES

Brophy, J, VanSledright, B.A., & Bredin, N(1992). Fifth grader's ideas about history expressed before and after their introduction to the subject. *Theory & Research in Social Education*, 20(4),440-489.

Funada Jiro(2012). Developing Lesson Plans for Social Studies in Junior High School to Explain Historical Causality Using an Explanatory Model to Teach the Unit on "Rise of Samurai and Formation of the Samurai Administration ". *Journal of research on education in social studies department*, 24,61-70.

Kato Hiroshi, Kurata Masahiko, Sato Takahiro, Ozawa Shinji(1988). Measurement and analysis of the structural understanding state by the hierarchical directed chart of the learning contents that a learner drew. *The IEICE Transactions on Fundamentals of Electronics, Communications and Computer Sciences*, A71(10), 1955-1965.

Ministry of Education, Culture, Sports, Science and Technology (2017). Concept of new course of study. http://www.mext.go.jp/a_menu/shotou/new-cs/__icsFiles/afieldfile/2017/09/28/1396716_1.pdf (accessed 2018-02.-05).

Nate Fumito, Tokutake Keitaro, Kojiri Tomoko (2016). Evaluation of Understanding Support System for Causal Relationship in Historical Learning. *IEICE technical report,*115(492), 303-308.

Novak, J.D(1990). Concept Mapping: A Useful Tool for Science Education. *Journal of Research in Science Teaching*, 27(10), 937-949.

Sato Takahiro(1987).*ISM structure learning method*. Meiji Tosho, 206p.

Shemilt, D(1983). The Devil's Locomotive. *History and Theory*, 22(10),1-18.

Voss, J. F., Carretero, M. （2000） *Learning and reasoning in history:International Review on History Education.* Volume2, Routledge, 428p.

Yui Osaburo (2011) Recent Problems in the High School Education of Geography and History. *SCJ forum*, 16(9),8-13.