Fostering Information Literacy through Inquiry-Based Learning in Japan

By Dr Yoko Noborimoto

Introduction

The rapid progress of information technology has changed the manner, quantity and speed of information transmission, altering our lives significantly. Information technology will continue to change greatly within our own lifetimes, such as in the utilisation of accumulated data and the development of artificial intelligence. In an information rich society, called a knowledge-based society, information can overwhelm, and it is necessary to have the ability to critically examine data and extract necessary information.

When conveying an opinion, it is necessary to not only state our assertion but to also convey that this is based on appropriate information. With the advent of an information society, the environment surrounding children is changing dramatically. Children must acquire information literacy to gain information, understand information, and to utilise it in persuading others.

> *Students who survive the 21st century in which international competition and innovation in various fields continually continues need to acquire thinking ability, judgment ability and expressive power to solve the problem by utilising information and ICT. In addition, students are required to attract attitudes to discover and set issues themselves and explore themselves and collaboratively in order to solve them. It is extremely important to nurture information utilisation abilities* (Ministry of Education, Culture, Sports, Science and Technology 2015).

Responding to an increasingly information-rich environment in Japan is an urgent issue.

From October 2013 to January 2014, a survey was conducted on information literacy for 5th grade and 8th grade students in Japan. The resulting report stated:

> *5th grade can read the organised information, but there is a problem in finding and associating specific information according to purpose from a plurality of web pages. Furthermore, there is a problem in organising and interpreting information and disseminating information according to the situation of the recipient.*

> *8th grade can read the organised information, but there is a problem in finding and associating specific information according to purpose from a plurality of web pages. Although it is possible to organise and interpret the information displayed in a list, there are problems in organising and interpreting information on a plurality of web pages and sending information according to the circumstances of the recipients* (Ministry of Education, Culture, Sports, Science and Technology, 2015).

A subsequent information literacy survey of 11th graders was conducted from December 2015 to March 2016. A trend was found similar to that recorded in elementary and junior high schools and the Ministry reported:

> *It is possible to read, organise and interpret the sorted information. It is weak to find or associate information according to purpose from multi-tier web pages with multiple pieces of information. It is weak to organise multiple statistical information according to conditions and to express opinions based on them'. 'It is weak to clarify what kind of information is necessary to infer the cause or tendency of an event* (Ministry of Education, Culture, Sports, Science and Technology 2016).

Japanese elementary school, junior high school and high school students are lacking in their ability to search subjectively for necessary information, and to think critically and express analysis in relation to this information.

In a national academic ability and learning survey conducted in fiscal 2016 by the National Institute for Educational Policy, it was noted:

> *When writing opinions, it is conscious of showing the grounds, but students do not care about whether the grounds are appropriate, weak points in which part is evidence or how to express expression. Although students decide the tasks on their own based on the information, it is weak in thinking about concrete information gathering methods to solve the problem* (National Institute for Educational Policy Research 2016a).

The results supported the findings of the Ministry of Education, Culture, Sports, Science and Technology 2016 information literacy survey in suggesting that students were found to be wanting in their ability to determine what information was

appropriate and in thinking about appropriate ways of gathering information to solve problems.

In 2015, PISA (Program for International Student Assessment) shifted to CBT (Computer Based Testing). One outcome of this change was students felt themselves incapable of retrieving information from multiple screens on a computer, analysing this information and responding to it. As the information environment surrounding children rapidly changes, it was reported by the National Institute for Educational Policy Research that:

> *It is weak to understand the information represented by the sentence accurately and to make use of it to form their own ideas. The connection between visual information and words is scarce, and it is weak to read and understand the meaning of perceived information* (National Institute for Educational Policy Research 2016b).

From these results, the ability of Japanese children to solve problems by gathering, analysing and expressing information in their own arguments is in short supply.

Based on the above, we developed a learning model and program to foster information literacy in junior high school students.

Model of Waza for Learning

We developed a program called 'Waza for Learning', which aims to develop 9th grade (aged 15) students' learning and problem-solving skills for application in a knowledge-based society. Specifically, it focuses on their ability to study independently. The program consists of 50-minute classes held twice a week for one semester.

Waza is a sequence of actions, steps, procedures, and methods for doing something skillfully.

The cross-curriculum nature of the program cultivates skills used as the basis for all studies, as the name 'Waza for Learning' suggests. 'Waza for Learning' is a direct translation from the English phrase 'learning skill'. However, the Japanese word waza means not only skills in general but also a great master's artistic skills. Waza is a sequence of actions, steps, procedures, and methods for doing something skillfully. Japan has an abundance of traditional waza that have been passed on by predecessors and are revered in the culture. Japanese people continue to develop and master various traditional waza such as in the ceramic arts, martial arts, and culinary arts.

Waza for Learning was initially based on the inquiry model from *Focus on Inquiry* (Alberta. Alberta Learning, & Alberta. Learning and Teaching Resources Branch, 2004). *Focus on Inquiry* shows how schools should develop learning that utilises the school library in order to encourage students' meta-cognition activities (Figure 1). The model of Waza for Learning is as follows: Decide on a Research Question, Collect Resources, Choose and Adapt Information, Organise Logically, Give a Presentation, and Evaluate (Figure 2). The Inquiry Map (center of Figure 2) illustrates the composition of a student's study or paper. Students can reflect on the information they have obtained using the Inquiry Map and advance their research in a spiral manner, going back and forth between each step of the model.

Figure 1

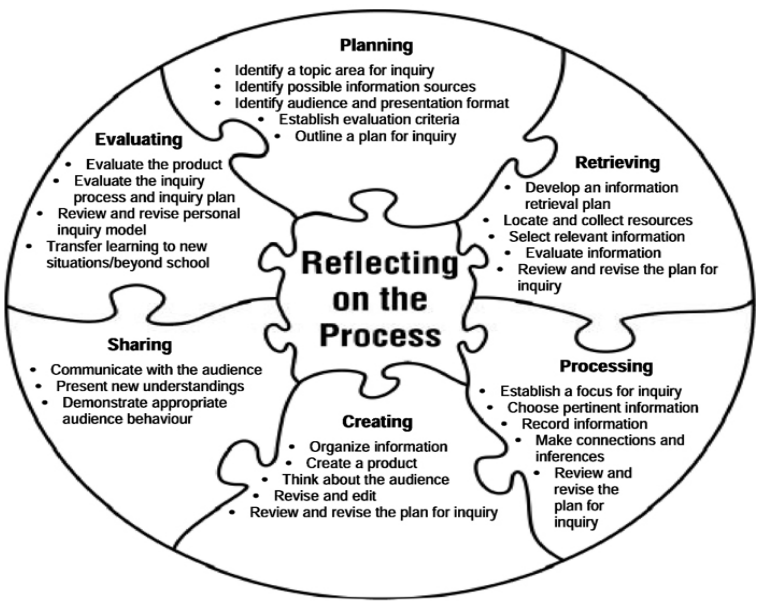
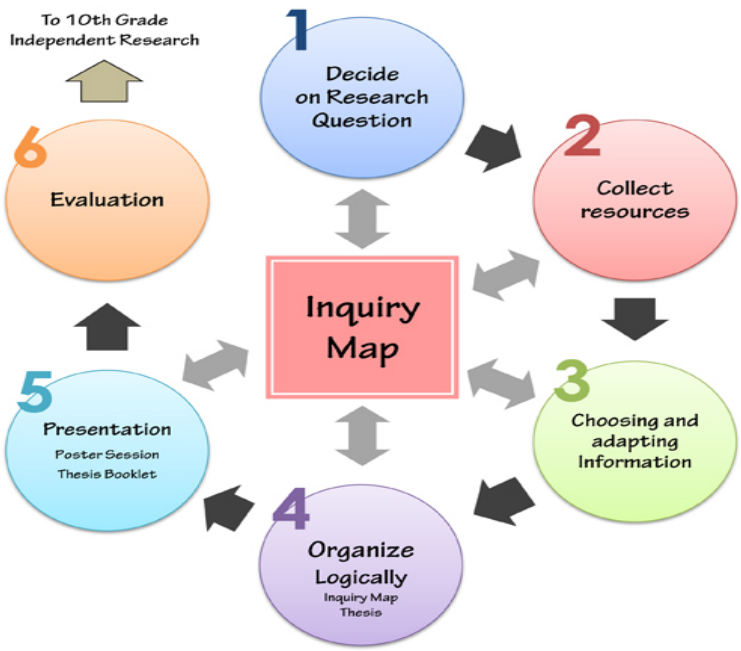


Figure 2



Purpose and Learning Environment

With advances in computer technology, children's environments are changing drastically. Buckingham (2003) points out that although children's cultural experience has changed dramatically in the past 50 years, schools do not reflect such changes. This situation illustrates that a new method of teaching and learning media is imperative. Waza for Learning is taught in the Multimedia Resources Center, which is an expansion of the traditional school library. The MMRC is designed to accommodate various activities including literature research, seminars, and discussions. Waza for Learning effectively integrates ICT.

The purpose of Waza for Learning is to cultivate language literacy and logical thinking skills. We implemented the program for 15 years. The chief purpose of Waza for Learning is teaching learning skills for study. The concrete learning purpose is tabularised in Table 1.

Table 1 Goals of Waza for Learning

1	Skill to decide on research questions (themes) based on one's own interests
2	Skill to collect, sort, and record information
3	Skill to classify and summarise information
4	Skill to provide supporting evidence for the answer to the research question and compose a paper
5	Skill to write a paper, maintaining logical consistency among the research question, conclusion, and evidence
6	Skill to effectively present other research details orally
7	Skill to ask effective questions

Teacher Organisation

Waza for Learning classes are team-taught by a teacher-librarian or an ICT teacher and another subject teacher. In 2014, a total of 10 teachers, including two teacher-librarians, two ICT teachers, two science teachers, one history teacher, two Japanese teachers and one mathematics teacher, took charge of six classes (Table 2). On each team, one teacher was a core teacher and the other participated in one meeting per week. Fundamentally, the core teachers would continue each year. Accordingly, the other teachers' workloads are eased.

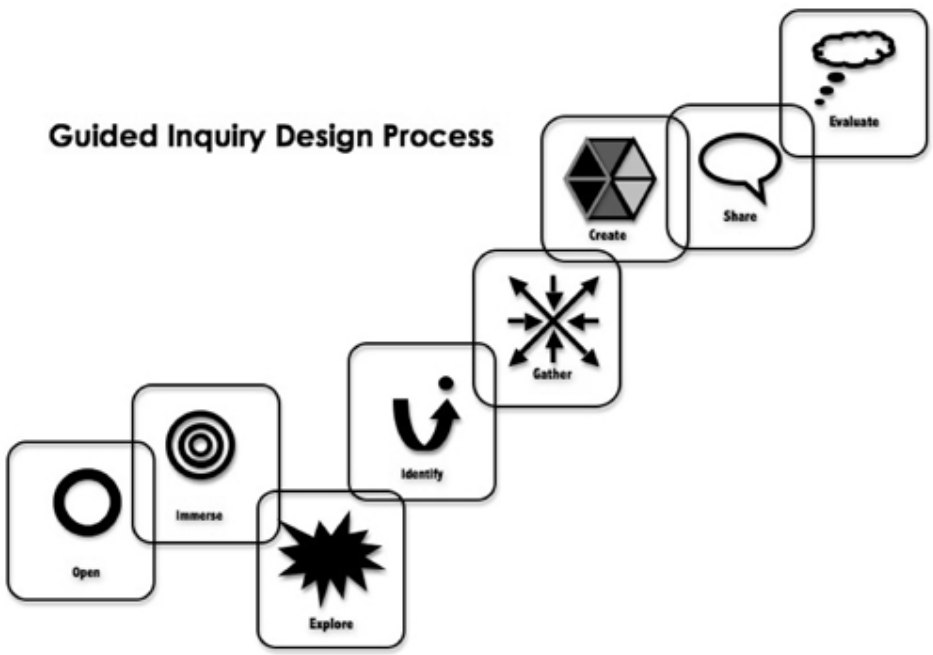
Table 2 Teacher Combinations

class	Team Teaching	
	Teacher 1	Teacher 2
1	ICT Teacher A	Science Teacher *
2		Japanese Teacher *
3	Teacher Librarian A *	History Teacher
4		Science Teacher
5	ICT Teacher B *	Mathematics Teacher
6	Teacher Librarian B *	Japanese Teacher

*core teachers

Moreover, we based the guided inquiry design process (Figure 3) on *Guided Inquiry*, which is defined by Carol Kuhlthau, who contributed to the theory establishment of information literacy education (Kuhlthau, 2012). The height in the figure shows the student's feelings (affective). The student feels certainty, optimism, confusion/frustration, clarity, a sense of direction/confidence, satisfaction/disappointment, and a sense of accomplishment in each step of the research process (Kuhlthau, 2004). According to this process, teachers can know in advance the changes of feelings that students may feel at each step of inquiry learning and guide the students to cope with any difficulties.

Figure 3



Program Schedule

Table 3 shows the program of Waza for Learning. The Japanese school year runs from April to March.

Table 3 Program of Waza for Learning (hour/time assigned)

Apr. to May	How to listen to a talk (1) Orientation to the library and program (6) How to draw a image map (2)
June to Aug.	How to formulate a research question (1) How to find books, use the online public access catalog, and browse books (2) Understanding copyrights, citations, and bibliographies (1) How to use online databases and encyclopedias (1) How to decide on a research question (2) How to choose and adapt information, grouping (1) How to draw an Inquiry Map (2) Logical thinking, change of viewpoint (1) Choosing and adapting information, creating an image map (4) How to use the public library (1)
Sept. to Oct.	Demonstration of Image map software (5) How to make slides for a presentation (1) Making slides (5) How to make a presentation (1) Skills in asking questions (2) Practice giving a presentation (5)
Nov. to Dec.	Poster sessions (4) Reflection on the presentation, examining a counterargument (2) Creating an Inquiry Map for a paper (2)

	How to write a paper and include quotes (1)
	Writing a paper (4)
	Revision of the paper and slides (4)
	How to write a summary (1)
	Speech training (1)
Jan. to Feb.	Exercises for speech (2)
	Final presentation (3)
	Continuity to the next year (1)
	Reflection, evaluation (1)

＊Japanese school year is from April to March

Program of Waza for Learning

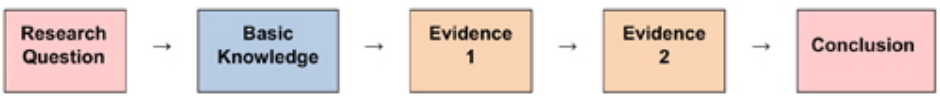
The main activities of Waza for Learning are:

1. Setting up the Research Question

It is quite early for a student to learn how to write a paper in the 9th grade. This is not the conventional approach in Japan. The teachers explain to the students that a paper is a text that logically proves that the conclusion is right, using persuasive objective evidence. A paper differs from a report (which collects and reports facts) in that it involves writing about their opinions and feelings, analysing literature and the given theme based on experience.

To clarify these characteristics, we asked students to structure their papers as follows: Research Question, Basic Knowledge or Background, Evidence 1, Evidence 2, Conclusion (Figure 4). These corresponded to chapters: research question includes the paper title and an introduction (Chapter 1), basic knowledge (Chapter 2), evidence is the main subject (Chapter 3, Chapter 4), and conclusion (Chapter 5).

Figure 4



Setting up the research questions is a very important part of the initial program. Judith (2010) mentions that although it is difficult to decide the purpose of the study at the beginning, it is very important to know why research is being conducted. In Waza for Learning, the research question is a theme connected with the students' interests and concerns relating to a direction or a future dream/goal. However, although each student determines a theme, since he or she has little knowledge, the theme is often vague, e.g., 'Is an environmental problem solvable?'

It is necessary to narrow down a question so that the students wonder whether it is appropriate for it to be so small (Todayama 2002). We discussed how to formulate a question by focusing on a theme when writing a paper, and we developed a worksheet that can help in determining the research question from a keyword of a study that a student wants to research. Furthermore, we limited the research questions to those that can be answered by Yes or No. This helped the students to verify their claim (conclusion) and easily provide supporting evidence.

2. Bibliography Management System and Evidence Book

After the research question is decided, the students gather information. The purpose of information gathering is for the students to see that there are both merits and demerits in sources of information, there is abundant information, and information can be found in more than one media. To help students discern the differences in media, we classified each medium into one of the following eight categories: books, magazines and newspapers, papers, Internet, online databases, conversations or interviews, movies, and sound. We assigned the following task: "Using three or more kinds of media, collect 10 or more pieces of information".

When gathering information, students need to enter their sources in the Bibliography Management System (Figure 5) and provide an evidence notebook. The Bibliography Management System classifies media. The students record their sources in their evidence notebook and summarise the contents. Accordingly, they can gather information while being aware of the differences in media.

Figure 5

We developed the Bibliography Management System to hold bibliographic information (Noborimoto 2016a). When writing a paper or making a presentation, students can output with text data by making the registered source information into a list of references. Students can see how many sources they have used in each media category. The teacher can also look through each student's progress.

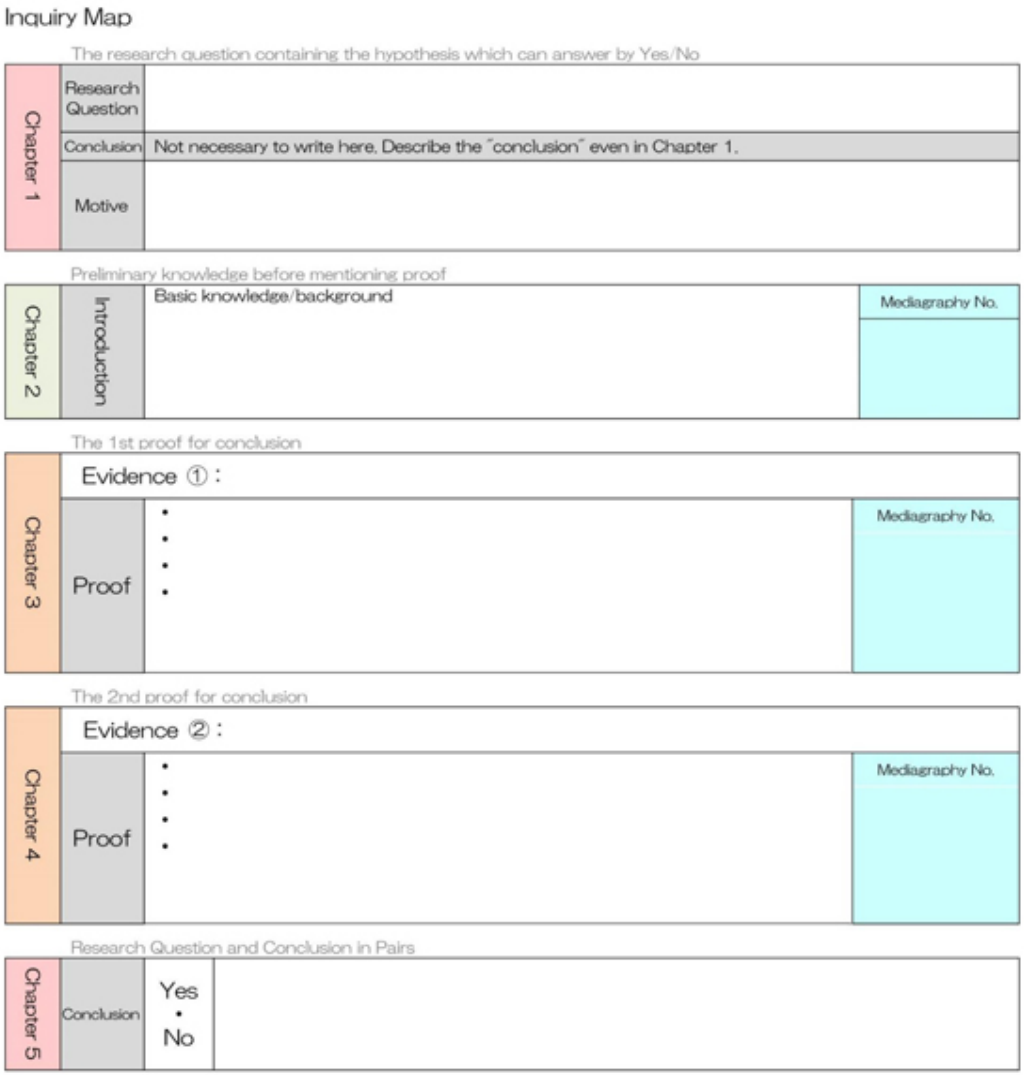
Furthermore, the teacher can check information on bibliographies that students have registered and send comments with corrections or other notes. The comment is displayed on a top page when the student logs in to the system. Students can inform the teacher that they have made a correction or responded to the issue by going to a pulldown menu in the correction column and changing the status from 'Finishing processing' to 'Settled'.

3. Information Gathering using Image Map and Inquiry Map

The students use Image Map for information gathering. They can discover the relationship between the keywords of a research question in a creative and fun way through this process. When considering a relationship using Image Map, students surround a keyword with a line and perform a group division.

After creating Image Maps, students make an 'Inquiry Map' (Figure 6), which includes logical information. The Inquiry Map was developed in a paper instruction format for 12th grade (Saitoh, 2008) and was adjusted for use in the 9th grade (Noborimoto, 2017). Inquiry Map fills in the research question and conclusion first. This is because the research question and the conclusion are always a pair. During the inquiry, the research question and conclusion might change frequently. Students then write out the evidence supporting their conclusion, provide basic knowledge, and write an introduction to the main subject. They can refer to the Image Map to ascertain whether there is evidence and basic knowledge. The evidence supporting a conclusion by Inquiry Map clarifies this, and it becomes clear how the evidence proves the conclusion. Since the data number of a bibliographic entry is also written, students can see which data are supported. The Inquiry Map is pivotal in Waza for Learning, a sketch of a slide creation of a poster session or paper creation. The teacher can check, before a paper is written, whether the relationships among the research question, conclusion, and evidence are logical.

Figure 6



4. Making Slides, Learning to Ask Questions and Giving Poster Sessions

Before writing a paper, students participate in a poster session. In this session, they logically summarise the contents obtained from the Inquiry Map in a slide show and present it. The number of slides is set to 10. When the slides are made, pages are first filled up with an itemised statement, and the students consider the whole composition. They consider and itemise important keywords so as not to create a long text. This prevents stagnation of their progress. Next, the students write a caption for a photograph, figure, or graph they have included. Then they start the process of visualisation using diagrams and emphasising important numerical data and keywords. Finally, they revise the overall presentation for color and design.

Students learn that there are open and closed question forms . . .

Since all the students are both presenters and audience members in the poster session, the skill of asking questions is taught. The teacher explains the effect of a question: if a question is asked, mutual understanding will deepen, and if the atmosphere is good, the speaker will be further motivated, resulting in a positive feedback loop. Students learn that there are open and closed

question forms, which should be used according to the situation. The teacher also gives hints for asking questions. Students then practice using the wrong example of a syllogism and thereby acquire the skill of listening and applying logic.

5. Paper Writing and Evaluation

After the poster session, the students inquire into the information again, create another Inquiry Map, and develop the final structural outline. The paper is required to be at least 3,000 Japanese characters (the equivalent of about 1500 words in English).

Results and Discussion

This study implemented and evaluated the inquiry-based learning program Waza for Learning, designed for 9th grade students. Although details are omitted here, the results of these learning programs were analysed using the information research skills (Noborimoto, 2016b) etc. The information research skills were adapted from the questionnaire created by Shioya and Horita (2008), who made elementary secondary education applicable for research by 9th grade students (Kasai, 2009). The evaluation showed that after participating in the program, students understood how to create research questions by themselves and could gather information using different types of media.

Further, according to the students' self-assessments, their knowledge of copyrights, ability to make presentations, and paper writing skills increased. Moreover, the evaluation of students' acquisition of information research skills indicated that the experimental group had strong mastery. Unlike college students, junior high school students do not have sufficient ability to adjust and execute learning process themselves, and it is necessary for teachers to support each process and lead to the next process.

As further research, we need to measure the results of the learning program five years and ten years after the students' participation to evaluate long-term effects. Future studies may also focus on improving the program, especially regarding students' ability to ask interview questions and create a summary report. Overall, this study contributes to the understanding of inquiry-based learning.

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References

Alberta Learning & Alberta Learning and Teaching Resources Branch (2004) *Focus on Inquiry: A Teacher's Guide to Implementing Inquiry-Based Learning*, Alberta Learning.

Bell, J. (2010) *Doing Your Research Project (open up study skills)* (5th edition), Open University Press.

Buckingham, D., & Sefton-Green, J. (1994) *Cultural Studies goes to School: Reading and Teaching Popular Media* (Critical perspectives on literacy and education). London, Bristol, PA: Taylor & Francis.

Kasai, Y., Ito, S., Goto, Y., Shioya, K., & Horita, T. (2009) 'Evaluation Research of the Information Literacy Educational Program for 9th Grade' in *Annual convention collected papers of Japan Society for Educational Technology* (25), pp. 675-676.

Kuhlthau, C. C. (2004) *Seeking Meaning: A Process Approach to Library and Information Services*. Libraries Unlimited. Inc.

Kuhlthau, C. C., Maniotes, L. K., & Caspari, A. K. (2012) *Guided Inquiry Design – A Framework for Inquiry in Your School*. Libraries Unlimited Inc.

Ministry of Education, Culture, Sports, Science and Technology, Japan (2009) *Explanation of the High School Course of Study: The Volume on the Period for Integrated Studies*. Tokyo: Ministry of Education, Culture, Sports, Science and Technology

Ministry of Education, Culture, Sports, Science and Technology, Japan (2015) Information literacy survey result, Accessed 17th May 2014 at: http://www.mext.go.jp/a_menu/shotou/zyouhou/1356188.htm

Ministry of Education, Culture, Sports, Science and Technology, Japan (2016) Information literacy survey result, Access 17th May 2016 at: http://www.mext.go.jp/a_menu/shotou/zyouhou/detail/1381046.htm

National Institute for Educational Policy Research (2016a) The Point of the Survey Results on National Academic Ability and Learning in 2016 School Year, Accessed 17th May 2016 at: http://www.nier.go.jp/16chousakekkahoukoku/16hilights.pdf

National Institute for Educational Policy Research (2016b) OECD Student's Learning Achievement Survey (PISA): countermeasures for Improving Reading Comprehension, Accessed 17th May 2016 at: http://www.nier.go.jp/kokusai/pisa/

Noborimoto, Y., Itagaki, S., Ito, S., & Horita, T. (2016a) 'Management of System to Support Student's Information Searching' in *Annual convention collected papers of Japan Society for Educational Technology* (32), pages 679-680.

Noborimoto, Y., Goto, Y., Ito, S., Kasai, Y., & Horita, T. (2016b) 'Achievement of Information Literacy Skills and Its Correlation Factors on Annual Inquiry Learning Curriculum' in *Japan Society of Educational Information*, 16 (1), pp. 29-34.

Noborimoto, Y., Ito, S., Goto, Y., Kasai, Y., & Horita, T. (2017) 'Development and Evaluation of a Worksheet for Understanding Logical Argument on Inquiry-Based Learning in Junior High School' in *Japan Journal of Educational Technology* 41 (Suppl), pp. 121-124.

Saitoh, Y. (2008) 'Paper Instruction for a High School Student: To the Method of Demonstration from Selection of a Theme' in *Japanese Private School Teaching Laboratory Bulletin* (43), Tokyo: Japanese private school teaching laboratory, pp. 7-70.

Shioya, K., & Horita, T. (2008) 'Study on Information Level of Junior and Senior High School Students' in *The Collection of Japan Society for Educational Technology Reports of Research 2008* (4), pp. 15-20.

Todayama, K. (2002) *The Classroom of a Paper: From a Report to a Graduation Thesis*. Tokyo: NHK Publishing.

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