Video Format Enhancing Self Learning on Mathematics for Deaf Students in Elementary School

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ABSTRACT

This research aimed to find the appropriate video format for self learning of deaf students in elementary school on the mathematics subject and to study the opinions of mathematics teachers on the video format. The participants were of 30 elementary mathematics teachers who taught deaf students. The instruments used in this research were as follows: 1) mathematics video clips for self-study, 2) questionnaire for the teachers who taught deaf students. This study was a quantitative research. The teachers were asked to watch mathematics video clips and were interviewed. Data were analyzed into 8 categories were contents mathematics, graphics and animations, Thai Sign Language, texts and Language, lesson design, presentation, exercises, and video usage. Descriptive statistics mean, standard deviation and percentage were employed to analyze the data. All participants were satisfied in mathematics video clips. The result found all of 8 categories mentioned above with the highest level of opinion which was in the range between 4.00 - 5.00 ($\overline{X}$ = 4.53, S.D. = 0.58). This study also gained knowledge of how to use an appropriate video format as self-learning tools for deaf students.

Key words: video format/ mathematic video clips/ deaf students/ self learning/ mathematic teachers/ elementary school

1. INTRODUCTION

Education is the foundation and important to determine the direction to develop the country's population to have knowledge and capabilities in various fields and developing the potentiality of the population; specifically, people with disabilities can be improved their quality of life by appropriated education for people with special needs. The policies of accessibility to educational service for people with disabilities have been manipulated. Department of Promotion and Development of the Quality of Life of the Disabled, Ministry of Social Development and Human Security of Thailand (2017) reported the number of people with disabilities that the total number of people with disabilities was 1,802,375 or 2.72 % of the total population. The number of people with hearing impairments was 329, 437 or 18.28% of people with disabilities. These people are in the age of studying in schools. The number of people with disabilities who enroll in schools was 1,194,415. It was 989,347 or 54.9% of people with disabilities in schools who are enrolling in elementary schools. Therefore, the Deaf learners enrolling in elementary schools should be facilitated in education management as well as the accessibility of teaching materials

Deaf communication requires sign language. Sign language need be used as the medium of communication among Deaf people because sign language is the first language of the Deaf and easier to perceive by the use of hands shape, position, location movement and facial expression (Sri-on, 2000). Hence, in Deaf education of Thailand, Thai Sign Language (THSL) should be the language of instruction in both of the schools for the Deaf and the Deaf inclusive schools in various contexts including instruction in classroom, teaching materials, and the communication between teachers and learners. Moreover, the teaching materials for Deaf learners should be comprised with THSL and more graphics instead of letters (Prateeppornsak, 2005).

The materials selection should be appropriate to the learners' needs such as the level of development, aptitudes, interests and learning styles. Nowadays, computer and online learning media have been becoming more extensive among Deaf people including live chatting, sending messages, social network, and access various information from YouTube. That is a video presented in an online format. The learners can access various contents and knowledge easily and quickly via computer and smart phone. This easier accessibility might be compatible with the concept of national development about Thailand 4.0 policy emphasizing the enthusiastic civilian in various aspects society development and maximized advantage of technologies utilization.

Many participants of the seminar of The Teaching and Learning Media for the Hearing Impaired in 2016 in the topic of "Future of Teaching Media for Hearing Impaired Students" demonstrated the opinions that self-learning multimedia mathematics teaching material is needed to support more effective teaching and learning. Furthermore, this material should be easy accessibility, no complex equipment, easy and quick preparation, and for free. In elementary school, students still lack educational media. This material can support teachers for more effective teaching and provide more time for teaching other subjects. These opinions accord with the study of problems and needs of using educational materials of teachers and Deaf students at the secondary level in the School for the Deaf Educational Technology Center Office of Non-Formal Education the Office of the Permanent Secretary for Education (2007) suggesting that teaching material video was needed the most from both of teachers and students because it was easy for access; also, had support such as sign language for describing the contents, pictures, and animations. However, there are some obstacles for users; for example, playing the teaching material video needs a video player. This obstacle can be resolved by online teaching material video.

The researcher is interested in studying the opinion of teachers on video format for self-learning on the mathematics subject of deaf students in elementary school. The videos were studied by applying the principles of instructional media design (ADDIE MODEL) and self-learning theory as well as taking into account the learning styles that are appropriate self learning for the deaf students. The result of this study can be suggested for developing self-learning multimedia teaching material of other subject and other levels.

2. METHODOLOGY/MAIN CONTENT

2.1 Objectives

The objectives of this study were as follows:

2.1.1 To study the appropriate video format for self learning in mathematics subject of deaf students in elementary school.

2.1.2 To study the opinions of mathematics teachers who taught deaf students with the video format.

2.2 participants

The researcher selected the participants using a purposive sampling. The populations of this study were the teachers in ten schools for the deaf that different at each region. The criteria selection of the participant was thirty mathematics teachers who have taught in schools for the deaf at least three years. They used Thai Sign Language for communicated and taught in class for deaf students.

2.3 Scopes of the research

The scopes of research were as follows:

2.3.1 Mathematics contents used in the research was in the primary level, which included addition, subtraction, multiplication, division, fractions and percentages, and were presented in the format of mathematics videos for deaf students to study on their own.

2.3.2 The research data have been collected for three months.

2.4 instruments

Data collection was done through questionnaires. The statistical analysis was employed to calculate quantitative results. The research instruments are as follow:

2.4.1 Videos of mathematics for self learning of deaf students in elementary school

Instructional Multimedia for teaching and learning Mathematics to the Core Education Curriculum in 2008 for deaf students Of the Educational Promotion and Development Fund for Handicapped Group of Special Education Bureau (2017) was a prototype video and used to collect information from teachers who taught deaf students. These mathematics videos have six learning units, including addition, subtraction, multiplication, division, fractions, and percentages.

These videos have been verified for accuracy and suitability by the professions, Thai Sign language deaf teachers and mathematics deaf teachers. Thai Sign Language used by the actors who performed as the teachers of deaf students was emphasized in various issues including contents, graphics, animations, and texts.

2.4.2 Questionnaire

The questionnaire of this study was modified from educational multimedia quality evaluation form of Phakom Limpiphiphat (Limpiphiphat, 2011). It was used to collect data from mathematics teachers of elementary deaf students in schools for the Deaf. The questionnaire was divided into 3 parts as follows:

Part 1 is the general information section of mathematics teachers including checklist and filling up information.

Part 2 is the opinions section. This part required the mathematics teachers rate their attitude of using the multimedia materials. The questionnaire contained 5 items using a five Likert-scale. There are fifty nine questions divided into 8 areas, including content, graphics and animations, Sign Language, text and language use, lesson design, presentation, exercises and the video usage.

Part 3 is a section of additional comments where respondents can express opinions by writing a message.

2.5 Data collection

Procedures of data collection are as follows:

1) Research ethics of human science research were conducted to request permission to collect research data from elementary mathematics teachers.

2) Research tools including self learning on mathematics video for elementary deaf student and questionnaire were verified by experts

3) After research ethics of human research was approved. Requesting cooperation letters were sent to target schools for the deaf for asking permission of research data collection.

4) Academic department and the mathematic teachers were requested permission of being participants of the study

5) Rights of research participants were informed carefully to the mathematic teachers.

6) Questionnaires were employed to collect feedback from mathematics teachers. Questionnaires were used after watching self learning video on mathematics subject for elementary deaf student.

7) Data obtained from the questionnaires of mathematics teachers were analyzed.

2.6 Data analysis

Steps for data analysis from the questionnaires of the opinions of the mathematics teachers in elementary school were as follows:

Part 1 frequency and percentage were used to analyze the demographic data of teachers who taught deaf students in mathematics.

Part 2 data were analyzed into 8 categories were contents mathematics, graphics and animations, Thai Sign Language, texts and Language, lesson design, presentation, exercises, and video usage. The data analysis used descriptive statistics mean, standard deviation and percentage were employed to analyze the data.

Part 3 data were used frequency counting of comments and content analysis.

3. RESULTS AND DISCUSSION

Results part:

After using mathematics videos for self-studying of deaf student at the primary education level that has been evaluated by experts to collect data with the group of teachers who teach deaf students in mathematics courses, which is by surveying their opinions on the video format, the data can be analyzed using basic statistics. Quantitative data from the mathematics teacher opinions show in part 1, general information and part 2, commenting this data analysis uses descriptive statistics mean, standard deviation and percentage were employed to describe the results. In part 3, additional suggestions use content-based text. The results of the study were as follows:

3.1 The results of demographic data analysis of teachers who taught deaf students in mathematics.

The gathered opinions on the video for self-studying are from a group of 30 teachers who teach mathematics courses from 10 schools for the deaf. The teachers have experience in teaching mathematics to deaf students for at least 3 years. The opinions on the video for self-learning in mathematics are as follows:

Most of the participants were female, (56.67%) and males, (43.33%). Most of them were between 31- 40 years old, (43.33%). The other (26.67%) were aged between 41 - 50 years old, (16.67%) are aged between 21 - 30 years old, and the remaining (13.33%) were aged between 51 - 60 years old.

Most teachers did not have disabilities, (56.67%). Deaf teachers accounted for (36.67%) and the least were the Hard of Hearing teachers, (6.66%).

The highest levels of education for most of the participants in the sample group were at the Bachelor's degree, which accounted for (53.33%), followed by the Master's degree (36.64%) and the certificate level (10 %).

Most of them graduated from deaf Studies, (30%), followed by educational administration, (26.67%), special education, (23.34%), Thai Sign Language Interpreter (10%) and mathematics, multimedia technology and Thai language at an accounted for (3.33 %).

Most of them were the experience of being a teacher to teach the deaf students for 11 - 20 years, (40%), followed by between 3 - 10 years, (30 %), then between 21 - 30 years (16.66%) and the least is in the range between 31 - 40 years and 41-50 years,(6.67%).

Most of them have the experience of being a mathematics teacher in the range between 3 - 10 years, (60%), followed by between 11 - 20 years, (33.33%), and the lowest is in the range between 21 - 30 years, (6.67 %).

Table 3.1 Number and percentage of teachers teaching deaf elementary students in mathematics courses from 10 schools, totaling 30 people, classified by background.

Variable	Frequency (N 30)	Percentage
Gender:		
Male	13	43.33
Female	17	56.67
Age in Years:		
21 – 30 years	5	16.67
31 – 40 years	13	43.33
41 – 50 years	8	26.67
51 – 60 years	4	13.33
Type of Disabilities:		
None	17	56.67
Deaf	11	36.67
Hard of Hearing	2	6.66
Highest education level:		
Certificate	3	10.00

Variable	Frequency (N 30)	Percentage
Diploma	0	0.00
Bachelor	16	53.33
Master	11	36.64
Philosophy	0	0.00
Graduate program:		
Special Education	7	23.34
Deaf Study	9	30.00
Thai Sign Language Interpreter	3	10.00
Educational administration	8	26.67
Mathematics	1	3.33
Multimedia Technology	1	3.33
Thai Language	1	3.33
Experience as a teacher in year:		
3 – 10 years	9	30.00
11 – 20 years	12	40.00
21 – 30 years	5	16.66
31 – 40 years	2	6.67
41 – 50 years	2	6.67
Experience as a math teacher in year:		
3 – 10 years	18	60.00
11 – 20 years	10	33.33
21 – 30 years	2	6.67

3.2 Analysis of data from the opinions of teachers who taught deaf students in mathematics.

Results from the questionnaire which has been divided into 8 areas consisting of content, graphic and animations, Thai Sign Language, text and language used, lesson design, presentation, exercises and the use of video, are shown in the chart below:

1. The teachers 'opinions on contents in mathematics videos.

Satisfaction on all items is more than 4.4. The highest point belongs to item "contents can be utilizes" (4.67) and the lowest point belongs to item "contents are complete" (4.4).
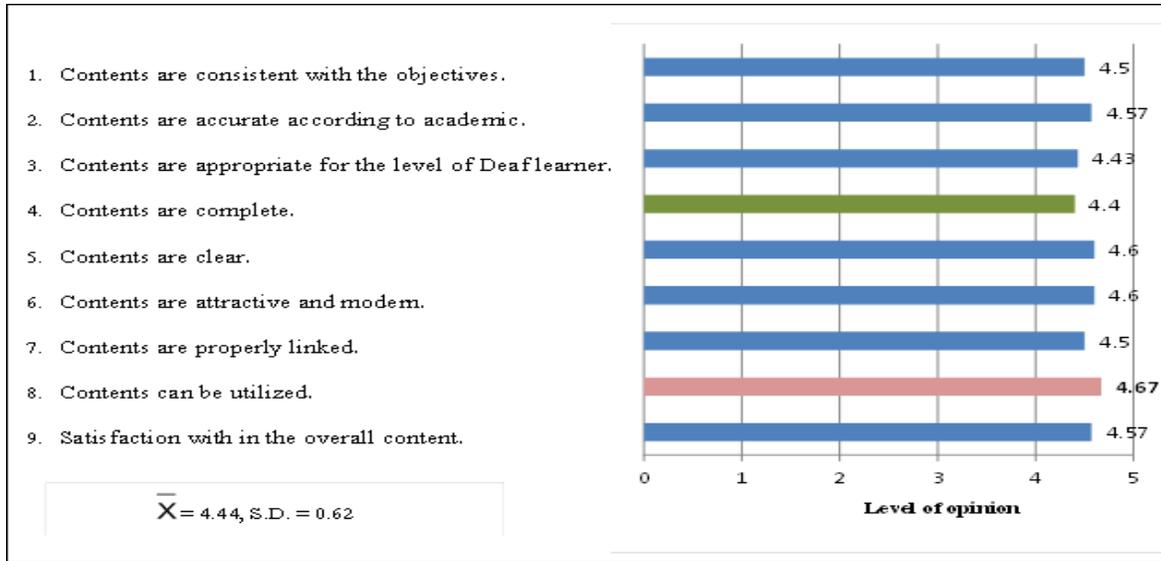
1. Contents are consistent with the objectives.	4.5
2. Contents are accurate according to academic.	4.57
3. Contents are appropriate for the level of Deaf learner.	4.43
4. Contents are complete.	4.4
5. Contents are clear.	4.6
6. Contents are attractive and modern.	4.6
7. Contents are properly linked.	4.5
8. Contents can be utilized.	4.67
9. Satisfaction with in the overall content.	4.57

$\overline{X} = 4.44$, S.D. $= 0.62$

Figure 1 the teachers' opinions on contents in mathematics videos.

2. The teachers' opinions on graphics and animations.
Satisfaction on all items is more than 4.4. The highest point belongs to item "graphics and animations are consistent" (4.53) and the lowest point belongs to item "graphics and animations are clear" (4.33).
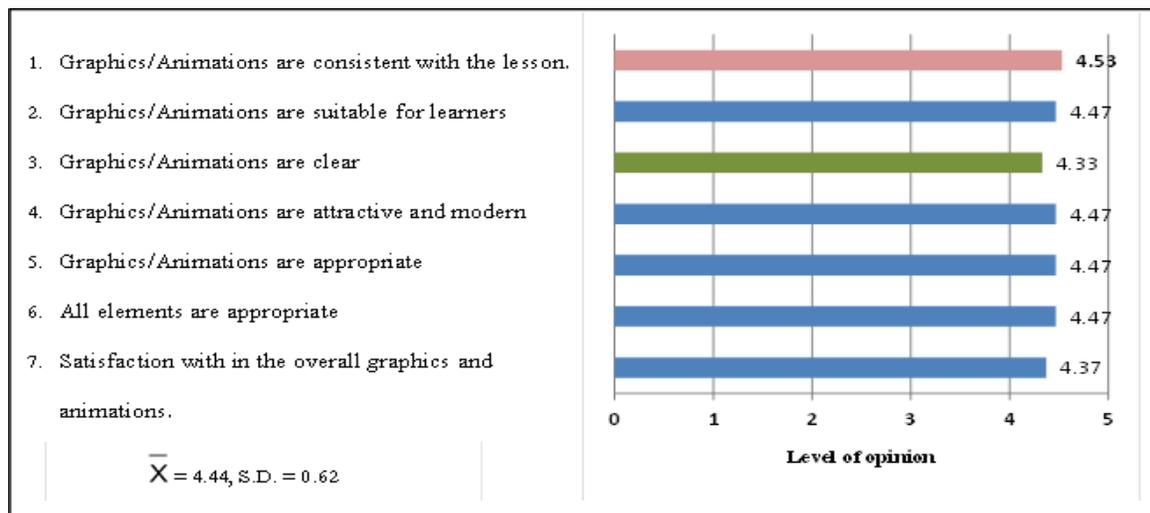
1. Graphics/Animations are consistent with the lesson.	4.53
2. Graphics/Animations are suitable for learners	4.47
3. Graphics/Animations are clear	4.33
4. Graphics/Animations are attractive and modern	4.47
5. Graphics/Animations are appropriate	4.47
6. All elements are appropriate	4.47
7. Satisfaction with in the overall graphics and animations.	4.37

$\overline{X} = 4.44$, S.D. $= 0.62$

Figure 2 the teachers' opinions on graphics and animations

3. The teachers' opinions on Thai Sign Language.
Satisfaction on all items is more than 4.4. The highest point belongs to item "Sign Language is suitable" (4.8) and the lowest point belongs to item "the facial expression used" (4.57).
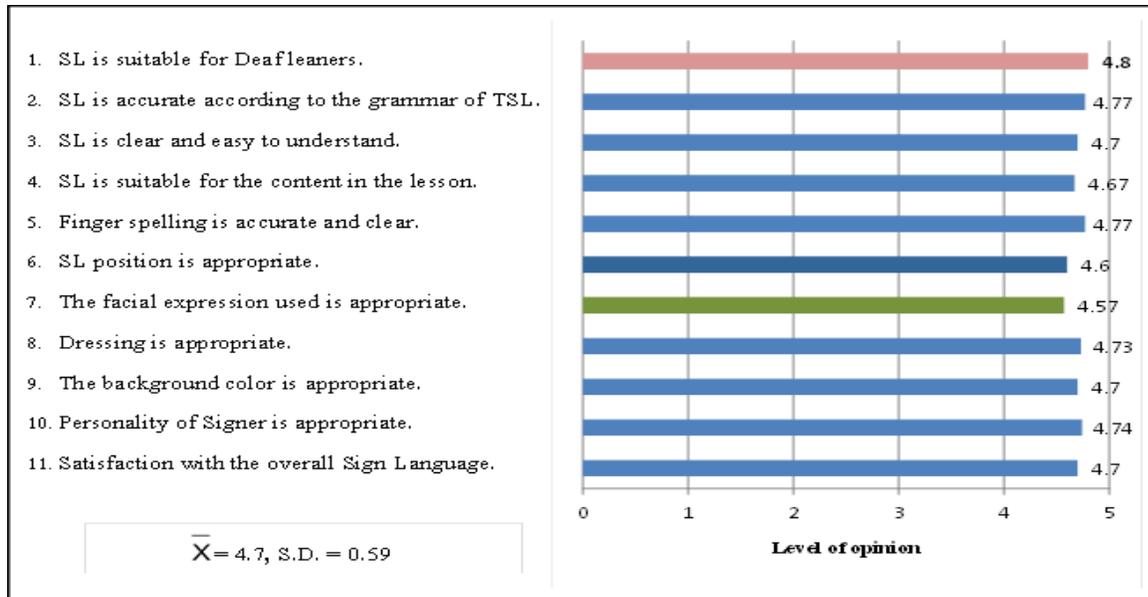
1. SL is suitable for Deaf leaners. — 4.8
2. SL is accurate according to the grammar of TSL. — 4.77
3. SL is clear and easy to understand. — 4.7
4. SL is suitable for the content in the lesson. — 4.67
5. Finger spelling is accurate and clear. — 4.77
6. SL position is appropriate. — 4.6
7. The facial expression used is appropriate. — 4.57
8. Dressing is appropriate. — 4.73
9. The background color is appropriate. — 4.7
10. Personality of Signer is appropriate. — 4.74
11. Satisfaction with the overall Sign Language. — 4.7

Level of opinion

$\bar{X} = 4.7$, S.D. = 0.59

Figure 3 the teachers' opinions on Thai Sign Language.

4. The teachers' opinions on texts and language used.

Satisfaction on all items is more than 4.4. The highest point belongs to item "language used is correct" (4.57) and the lowest point belongs to item "the font size" (4.30).

1. Language used is correct according to the language. — 4.57
2. Language used is appropriate for learners. — 4.5
3. Language used is clear and easy to understand. — 4.47
4. The length of the text used is appropriate. — 4.43
5. The font used is appropriate. — 4.47
6. The color of the font is appropriate. — 4.43
7. The font size is appropriate. — 4.3
8. Satisfaction with the overall texts and language. — 4.43

Level of opinion
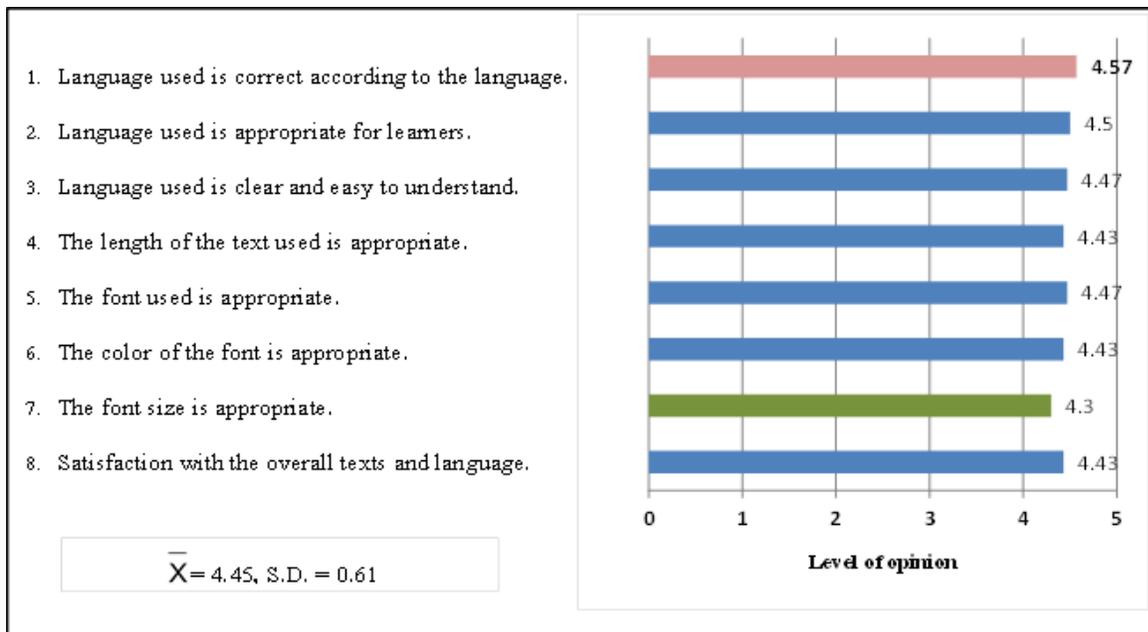
$\bar{X} = 4.45$, S.D. = 0.61

Figure 4 the teachers' opinions on texts and language used.

5. Shows the teachers' opinions on lesson design.

Satisfaction on all items is more than 4.4. The highest point belongs to item "overall lesson design" (4.63) and the lowest point belongs to item "graphic are beautiful and appropriate" (4.47).
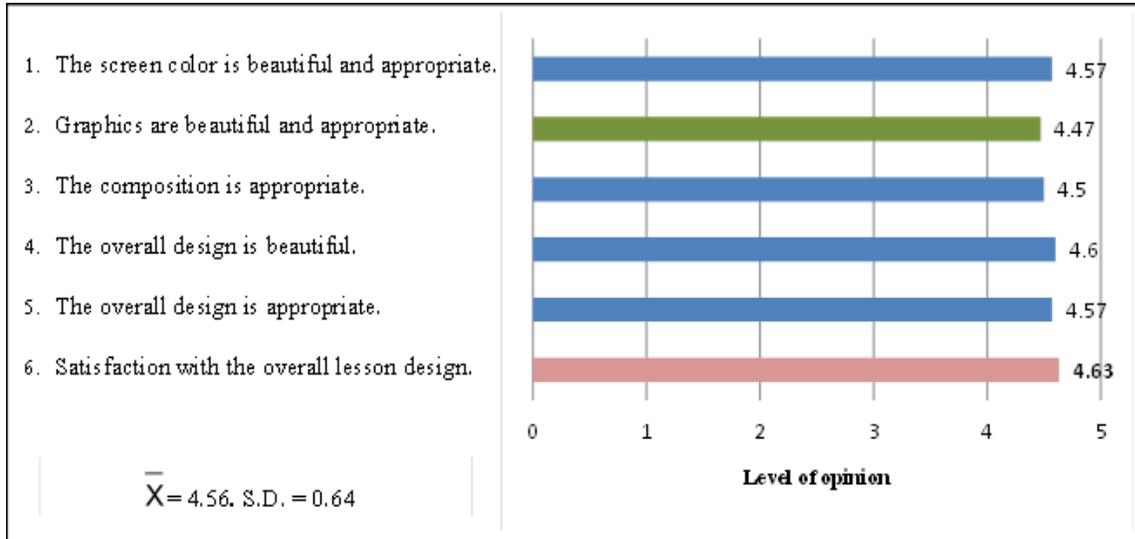

Figure 5 shows the teachers' opinions on lesson design.

6. The teachers' opinions on presentation.

Satisfaction on all items is more than 4.4. The highest point belongs to item "overall presentation" (4.57) and the lowest point belongs to item "overall presentation" (4.43).
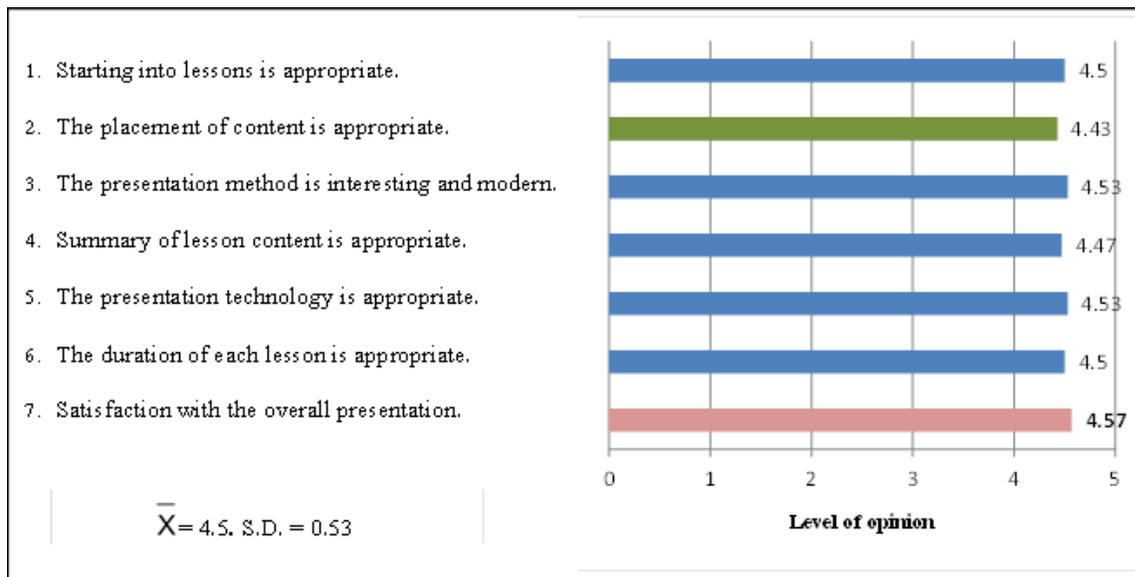

Figure 6 the teachers' opinions on presentation.

7.   The teachers' opinions on exercise.

Satisfaction on all items is more than 4.4. The highest point belongs to item "exercises are consistent" (4.63) and the lowest point belongs to item "the number of exercises" (4.43).
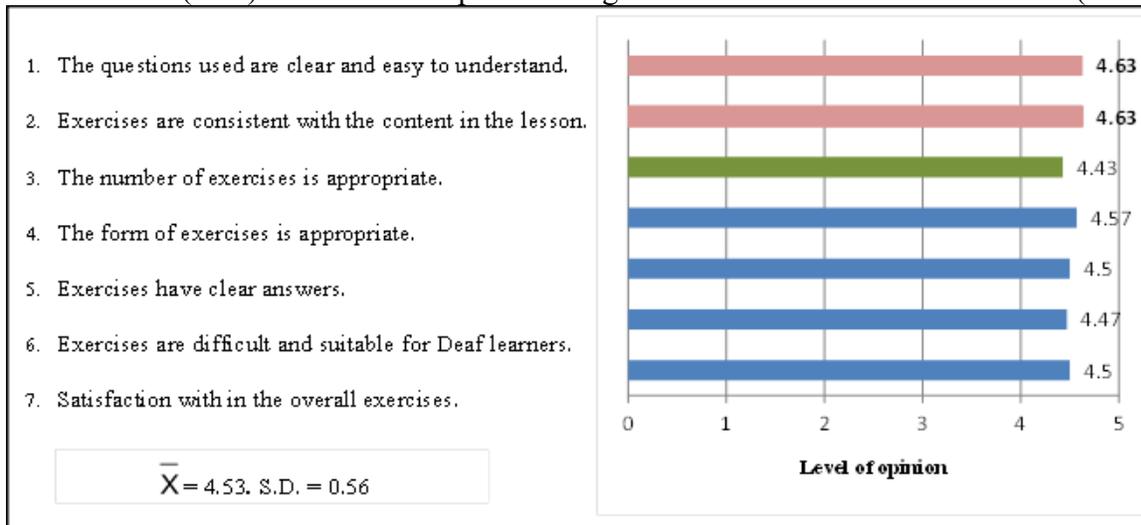

1.   The questions used are clear and easy to understand. — 4.63
2.   Exercises are consistent with the content in the lesson. — 4.63
3.   The number of exercises is appropriate. — 4.43
4.   The form of exercises is appropriate. — 4.57
5.   Exercises have clear answers. — 4.5
6.   Exercises are difficult and suitable for Deaf learners. — 4.47
7.   Satisfaction with in the overall exercises. — 4.5

$\bar{X} = 4.53$, S.D. = 0.56

Figure 7 the teachers' opinions on exercise.

8. The teachers' opinions on video usage.

Satisfaction on all items is more than 4.4. The highest point belongs to item "overall video usage" (4.57) and the lowest point belongs to item "learners can be active themselves" (4.37).

1.   Learners can activate themselves. — 4.37
2.   Learners can use to learn by themselves. — 4.4
3.   Helps to save money. — 4.5
4.   Satisfaction with the overall video usage — 4.57
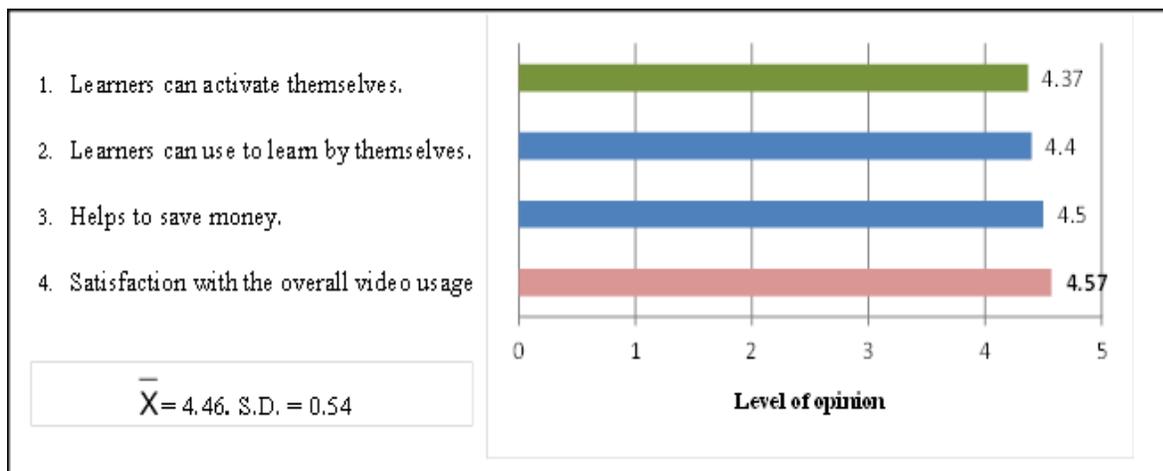
$\bar{X} = 4.46$, S.D. = 0.54

Figure 8 the teachers' opinions on video usage.

The summary of the results of the questionnaire analysis.

The results of quantitative data analysis obtained from answering the questionnaires of mathematics teachers who taught deaf students at the elementary schools. The result showed that most of the teachers have opinions about the format of the video in the Thai Sign Language used is the most appropriate ($\bar{X} = 4.7$), the lesson design ($\bar{X} = 4.56$), the content ($\bar{X} = 4.54$), the

exercises ($\overline{X}$ = 4.53), the presentation ($\overline{X}$ = 4.5), the video usage ($\overline{X}$ = 4.46) and in terms of text usage and language ($\overline{X}$ = 4.45, SD = 0.61), and graphics and animations ($\overline{X}$ = 4.44). All 8 areas mentioned were obtained highest level of opinion which is in the range between 4.44 – 4.7 ($\overline{X}$ = 4.53). Therefore, the multimedia instruction might be appropriate to employ as a model for developing self learning videos for deaf students.
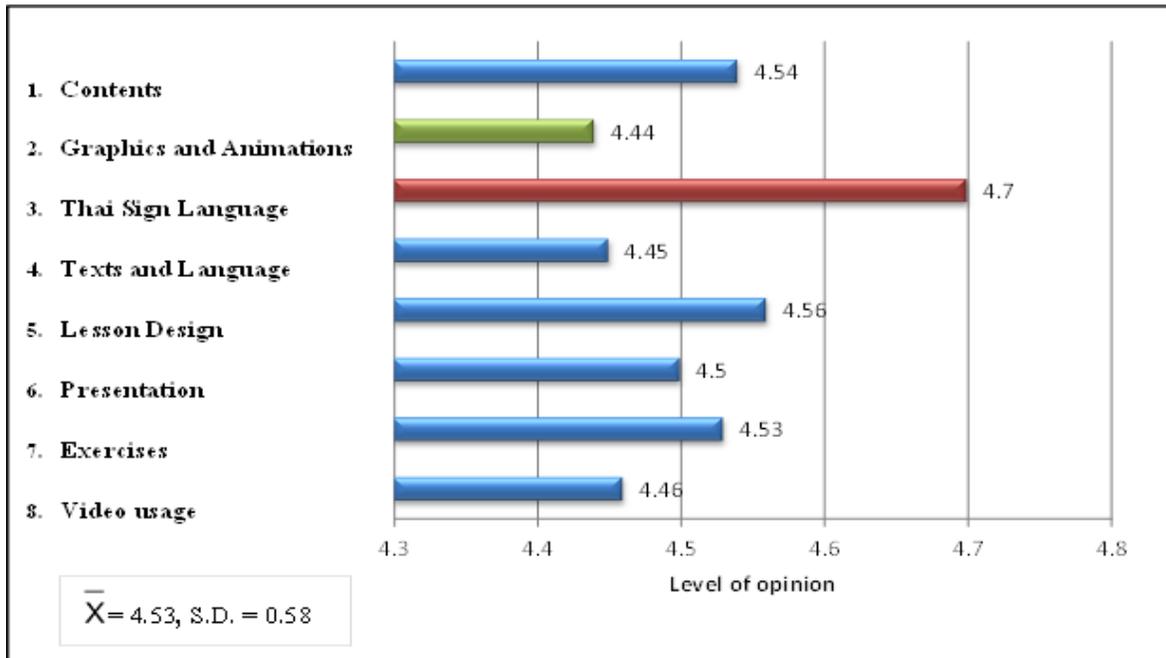

Figure 9 the opinions about mathematics videos of teachers who taught deaf students in 8 areas.

3.3 The additional comments of mathematics teachers on video formats.

3.4.1 The video format of deaf students self learning should be further developed in other subjects and other levels as well because it is a benefit and suitable for many deaf students. They can learn by themselves, accessibility and teachers can be used as instructional media.

3.4.2 The number of exercises is too small. It's should add about 10 exercises to allow students to review more lessons.

Discussion Part:

3.4 The results of the study of video formats suitable for self learning mathematics of deaf students in elementary school.

3.4.1 Content

The content used in the lesson for deaf students should be consistent with the learning objectives. Academic accuracy was clear and easy to understand. The content of each topic must be linked in the same direction. The result are consistent with the research of Somboon, P., Suppajanya, P., Chanheng, S., Jitwiriyatam, T.& Yoksuriyan, S. C.I. (2013) proposed guidelines for designing content that must be accurate, interesting, modern and appropriate to the level of deaf learners who can self-learning.

3.4.2 Graphic and animation

Graphic and animations in the videos for deaf students must be designed to be consistent in the same direction. The position of the slide and the animation should be in the same position on every page. In addition, creating story telling lessons helps deaf learners learn better.

3.4.3 Sign Language

The Sign Language used in the video based on recommendation of the experts including 3 deaf teachers teaching Thai Sign Language, 3 sign language interpreters, and 3 deaf teachers teaching mathematics. The advices from the school teachers were useful for developing appropriate. Thai sign language used in content of the lesson and the learning level of the learners as well. In addition, the appropriate color of the background is dark tones and contrasts with the skin and the sign language costume. Finger spelling must be accurate and clear. The use of the facial expression of the Sign Language must be clear and appropriate for the sign language used. In accordance with the elements of Thai sign language, including hands shape, position, location, movement and facial expression (Sri-on, 2001).

3.4.4 Text and language

The development of video for deaf students. The language or text used must be short, concise, and easy to read and clear. The size of the font must be look clear size, not too big, not too small. The font style must be easy to read and suitable for the overall design of the lesson.

3.4.5 Lesson design

The lesson design for deaf students is different from the design of lessons for general design. There must be a Sign Language for deaf learner. In accordance with the research of Boondeecharoen (2007), this studied the screen design of the multimedia test, Thai sign language for the deaf, that the design should be divided into 4 parts for each part to use different colors. Each topic has numbers indicating the order. The alignment of the elements should always be in the same position. The position of the sign language display should be in the first position. Then follow with pictures and text which is suitable for learning methods of deaf students.

3.4.6 Presentation

The lessons that are suitable for that deaf student must have instructions for using the lesson first. Then there must be a sequence of content for each topic that is appropriate from easy to difficult. There is an overview of each topic to see in this lesson, along with a sign language, explaining the lesson in each topic.

3.4.7 Exercise

Exercises suitable for that deaf student should use the accompanying picture and use a short message, clear text using and simple questions with clear answers. Questions in the exercises should be linked to the content of the lesson.

3.4.8 Video usage

Video presented in an online network format. It's making it accessible to use anywhere, anytime, convenient to use and can be used with portable electronic devices such as smartphones and tablets etc.

4. CONCLUSIONS

The study of video format enhanced self-learning on mathematics for deaf students in elementary school. The results from questionnaire can be summarized as follows:

1. The results in demographic data showed that the most of them were female, age between 31 to 40 years old, graduated with a bachelor's degree, graduated program of Deaf Studies, with experience to teach deaf students between 11 to 20 years and being a mathematics teacher between 3 to 10 years.

2. The result about the appropriate video format for self-learning in mathematics subject of deaf students showed that the opinions on video format of mathematics teachers who taught deaf students in elementary schools can be explained in 8 areas/topics. Most of teachers agreed that "the Thai Sign Language used is the most appropriate" (4.7). Thai Sign Language were translated by 3 groups of expert; Thai sign language deaf teachers, mathematics deaf teachers and, and sign language interpreters. The next topic, lesson Design (4.56), that was designed and verified by professions; mathematics Deaf teachers, Sign Language Interpreters and, multimedia developers. The next topic, contents (4.54), the content used in the lesson from educational curriculum that deaf students learn in school and the content was corrected according to academic principles and has been checked by professionals. The next topic, exercises (4.53), that should be presented at the end of each lesson and include about 10 items or more for deaf students can review on their own. The question in exercises must be clear, short, easy to understand and answers should have clear solutions. The next topic, presentation (4.5), presentations of the lesson should include clear learning objectives and starting into lessons should be interesting in each chapter. The next topic, video usage (4.46), the deaf students can self learning on the lesson because they can learn anywhere, anytime on computers and smartphones. However, teachers should help guide to use video online in the first time for deaf students in grade 1 to 3. The next topic, texts and languages (4.45), should be clearly defined, short, concise, easy to understand, font style, size and color used must be beautiful and clear. The last topic was graphics and animations (4.44), which help make the lessons interesting and easy to learn. Therefore, graphics and animations design must be easy to understand, beautiful and modern.

Future Recommendations:

This study was data collected with limited number of thirty mathematics teachers who taught deaf students from ten elementary schools in five regions of Thailand. Therefore, there should be done with lager sample size.

In addition, this research has collected qualitative data with thirty deaf students by semi-structured in-depth interviews on opinions about self learning on mathematics videos for deaf students in elementary schools. That can use the information in developing videos suitable for deaf students which will be presented in the next research.

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