

What are the effects to students of learning with ICT in a Chinese History class? : An action Research

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Abstract: This paper addresses the issue of integrating information and communication technologies (ICT) into Chinese History learning. It is generally believed that since ICT enables a multi-sensory approach to both teaching and learning, students' interest could be easily aroused and motivation would be improved. I argue in this paper that though motivation is a prerequisite for learning, whether it could be transformed into "meaningful learning" is another matter. The use of "meaningful learning" in this paper follows the road of the constructivists. It is interpreted as the willingness of students to extend their learning to the designated historical events after lessons. Should students' responses are positive, we could conclude that a "transformative process" will be happened to those students and new understandings to existing knowledge occurred. This paper undertakes an action research with a class of Secondary Four students as the target group. The focus is to investigate the relationship between ICT and Chinese History learning. The research questions are would students' interest be aroused with the introduction of ICT? Would ICT bring meaningful learning to students? The results and findings show that students' interests have been aroused and motivation improved. However, the transformation from motivation to meaningful learning is not apparent. There is no concrete evidence that respondents would extend their learning after the research lessons.

Keywords: ICT, Chinese History learning, meaningful learning, action research

Introduction

As in other parts of the world, integration of information and communication technologies (ICT) into instruction is a major challenge for every teacher in Hong Kong. Since ICT enables a multi-sensory approach to both teaching and learning, it is generally believed that students' interest could be easily aroused and motivation would be improved as well. Motivation in a sense is a prerequisite for learning. However, whether the starting point could be transformed into meaningful learning is another matter. A secondary school headmaster involved in an ICT research study indicates the concern in this respect:

"ICT is seen to improve motivation, makes classroom management easier, makes subject topics visually attractive, but long term impacts on attainment are not always apparent."(Passey et al, 2004: 69)

The headmaster's concern brings out Jonassen's learning concept: "learning from technology" versus "learning with technology". (Jonassen et al. 2003) By "learning from technology", technologies are viewed as hard ware and tools. For "learning with technology", "Learners and technologies should be intellectual partners, where the cognitive responsibility for performing is distributed by the part of the partnership that performs it the best." (Jonassen et al., 2003:11) Technology as an "intellectual partner" is to support learning to:

- help learners to articulate and represent what they know;
- reflect on what they have learned and how they came to know it;
- support learners' internal negotiations and meaning making;
- construct personal representations of meaning;
- support mindful thinking.

(Jonassen et al., 2003:12)

Therefore should a teacher only be satisfied with playing the role of attention-grabber, i.e. motivate students' interest; meaningful learning would never be occurred. For the constructivists (such as Jonassen), meaningful learning should be "a personal, reflective, and transformative process where ideas, experiences, and points of view are processed into something new." (Muir-Herzig 2004:113). Constructivists believe that "we build up knowledge by having experiences. When we integrate new experiences into our existing knowledge, new understandings are created and learning occurred." (Haywood and Hutchings 2004:174).

The present research study follows the road of the constructivists. The objective is to investigate the relationship of Chinese History learning and the use of ICT. The following research questions will be addressed:

1. Would a class of Secondary Four Chinese History students' interest be aroused with the introduction of ICT?
2. Could they achieve meaningful learning with the introduction of ICT to lessons?

The research questions put emphasizes on "meaningful learning". By "meaningful learning" in the present study, we mean the willingness of students to extend their learning to the designated historical events after lessons. Should students' responses are positive, we could conclude that a "transformative process" will be happened to those students and new understandings to existing knowledge occurred.

Action research and design study

Definition

Although the meaning of “action research” receives wide disagreement in many key issues since Kurt Lewin coined the term in about 1934 (Mills, 2003:5), most people (e.g. Mills, 2003; Herr, 2005) agree on the following:

1. Action research is conducted by the insiders, i.e. teachers or other individuals in the teaching/learning environment;
2. Since insiders themselves are as researchers, some forms of intervention are unavoidable in research setting;
3. Data or evidences are gathered in school or classroom settings;
4. The purpose of action research is to solve the pressing problems arising from teaching or learning. The shared goal is to improve lives of students and teachers.

These characteristics constitute the direction of the present research. The present action research takes a four-step process, which is developed from Mill 2003 and Herr 2005:

1. Identify an area of focus from teaching or learning.
2. Develop a plan of action to improve what is already happening.
3. Act to implement the plan: collect data, analyze and interpret data.
4. Plan subsequent action or cycle of actions for further researches.

Area of focus

The area of focus is to investigate the relationship between ICT and Chinese History learning. Would students’ interest be aroused with the introduction of ICT? Would ICT bring meaningful learning to students?

Action Plan

The research team included three members, the researcher- the present writer and two helpers- Mr Tang and Ray. Ray was a laboratory assistant in the school Multi-media Learning Centre (MMLC). The present writer (here after Mr Yau) and Mr Tang were both full time secondary school teachers at the time of research, with more than ten years teaching experience in senior class of the subject Chinese History. The MMLC was equipped with one teacher computer and forty-five student computers. Teacher and students in the MMLC were able to communicate with each other through the intranet network. All the computers in the MMLC could access the Internet with broadband speed.

The research was conducted in May of 2004. The target group of study was a class of secondary four students at the time of research. There were forty-one students in the class. During the process of research, one student was absent from class for two lessons; therefore

the numbers of respondents ranged from forty to forty-One. All respondents took Chinese History as their elective subject and the subject teacher was Mr Yau.

The research included three stages: preparation stage, learning stage and consolidation stage.

Two lessons with thirty-five minutes per each were spent for the preparation stage. Background, aims and process of study were introduced in the first lesson. The main reference material for students was the designated textbook. The topic of study was “The 1911 Revolution and the birth of the Republic of China”. We chose this topic for two reasons. Learning with ICT was a complete new mode of learning in the subject of Chinese History in the target class. Students’ adaptability and their interests must be considered. Dr Sun Yat-sen, the main leader in the 1911 Revolution is a well-known historical figure for local students. Furthermore, there are quite a number of historical relics about revolutionary activities in Hong Kong. From our experiences, students’ motivation should be higher if they have background knowledge in the topic. Another reason is that although it is a “hot topic” for students, it is not a ‘hot topic’ for examination. The target group will attend the public certificate examination in the following year; it is our responsibility to keep the negative impact (if any) on academic performance of students to the minimal. That means in case adverse effects are seen in the study, it will not lead to poor examination results in the public examination.

A Pre-test was designed in the preparation stage. It was conducted in lesson two. The Pre-test consisted of thirty multiple-choice questions which were selected from the past public examination questions. All the questions were “new” questions in a sense that students had not encountered the questions during the class before. The results of the Pre-test were compared with the results from the Post-test.

The learning stage from lesson three to lesson five required students to learn with designated software and from the Internet. The ‘e-learning for Certificate Chinese History, 2002 evaluation version’ software, developed by Hanlung information Ltd. was adopted. We chose this e-learning package for the reason that it was the only relevant package we could find at the time of study. Prior consent was sought to the company and we were granted the permission to use it in free.

The lessons were taken place in the MMLC. Ray had installed the learning software in advance so that every student could access the software when they logged in their own computer. Job duty was assigned to students in the beginning of every lesson. The intranet

network allowed students to write message to Mr Yau and classmates. Mr Yau would response at once if time allowed. Students were free to access the Internet to search relevant information from the websites. Some relevant websites were given to students or they could search in their own ways. Whenever technical problems arose, Ray would offer help.

The third stage was consolidation stage. It consisted of two lessons: lesson six and seven. A Post-test was held in the classroom in which the format and the content were exactly the same as the Pre-test. Unclear concepts, ambiguity and students' questions were dealt with in these two lessons. Main teaching and learning points were repeated and emphasized as well. A questionnaire with 42 questions about the effectiveness of this new mode of learning was designed as round up session to the whole study. Students could write their comments on the questionnaire if they wished.

Results and discussions

Pre-test and Post-test

The two tests were content-based with the purpose of comparing the performance of individual students before and after learning with ICT in a particular Chinese History topic. The results of students' performances are shown in Table 1.

All the students in the study attempted both the Pre-test and the Post-test. The Result columns indicate the raw marks the students achieve. The full marks are thirty in both tests. The Differences columns indicate the differences between Pre-test and Post-test of each individual student. The method of calculation is that score in Pre-test subtracts from score in Post-test. Therefore score with positive "+" sign indicates performance of a student is better in Post-test while with negative "-" sign indicates performance of a student is better in Pre-test. '0' score just means performances are the same in the Pre-and Post- tests.

Table 1: *Results of the Pre-test and the Post-test*

Answer Script No.	Results		Differences	Answer Script No.	Results		Differences
	Pre-test	Post-test			Pre-test	Post-test	
1.	16	17	+1	22.	14	19	+5
2.	19	22	+3	23.	9	12	+3
3.	10	12	+2	24.	7	17	+7
4.	13	15	+2	25.	15	20	+5
5.	12	12	0	26.	11	11	0
6.	14	14	0	27.	8	12	+4
7.	7	17	+10	28.	13	18	+5

8.	7	13	+6	29.	9	10	+1
9.	5	12	+7	30.	8	13	+5
10.	13	13	0	31.	12	8	-4
11.	6	12	+6	32.	6	10	+4
12.	13	12	-1	33.	16	16	0
13.	5	7	+2	34.	14	18	+4
14.	7	10	+3	35.	14	17	+3
15.	11	14	+3	36.	12	16	+4
16.	13	17	+4	37.	13	16	+3
17.	11	11	0	38.	11	16	+5
18.	8	13	+5	39.	10	11	+1
19.	10	7	-3	40.	9	11	+2
20.	13	14	+1	41.	18	21	+3
21.	12	13	+1				

We must note that the differences found between two tests would be probably attributed to chance. Here comes the question of internal validity. In order to test whether two tests are statistically significant, we use the paired-samples *t* test procedure to evaluate the mean of the differences between the Pre- and Post- tests. The data is computed and analyzed through the statistical package SPSS 14.0 for windows. Table 2 to 4 show the results of analysis.

Table2: *Paired Samples Statistics*

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Posttest	13.8780	41	3.59997	.56222
	Pretest	11.0732	41	3.44522	.53805

Table 3: *Paired Samples Correlations*

		N	Correlation	Sig.
Pair 1	Posttest & Pretest	41	.660	.000

Table 4: *Paired Samples Test*

		t	df	Sig. (2-tailed)
Paired Differences				

Pair 1 Posttest- Pretest	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		6.174	40	.000
				Lower	Upper			
				2.80488	2.90878			

Table 2 provides descriptive statistics. The average Pre-test score is 11.073 with a SD 3.445, while the average Post-test is 13.878, with a SD of 3.599. Table 3 displays a Pearson Correlation between the two sets of scores, which is 0.660. Table 4 provides the test statistics. The paired difference between these two mean scores is presented along with *t*, and the significance level and standard error of this mean. The difference between two means is 2.804 and the standard error of means for this sample size is 0.454. The *t*-value of the difference between the sample means is 6.174, which has a two-tailed significance level of 0.000 (p-value) with 40 degrees of freedom. The significance level of 0.000 does not mean that the probability is 0. If it is less than 0.0005, SPSS displays it as 0.000. The 95% (0.05) confidence interval of 1.886 to 3.723 is shown also on the table. Since the p-value 0.000 is lesser than 0.05 the differences between the means is significant. That is the differences between the Pre- and Post- tests are significant.

Statistically significant does not necessarily be educationally significant. In the present study, the average Pre-test score is 11.073 while the average Post-test is 13.878. Approximately, 2.8 average scores progress are seen for the Post-test. However, this 2.8 score increase might not be a real difference. The increase is probably based on chance rather than the progress made by the respondents. In order to increase the reliability of the results, we decide to compare the results with the public examination. The average passing percentage i.e. Grade E for Chinese History in the Certificate Examination in the past few years is about 40 % of total score. If a student wants to achieve Grade D, she/he probably should score 50 to 55% of total score. Therefore, the difference between Grade D and E in the Certificate Examination in the subject of Chinese History ranges from 10 to 15%. Mr Yau and Mr Tang assume that if a student can have 13% (the medium of 10 to 15 %, that is four questions in the present study) progress in the Post-test, the progress would be considered as a meaningful one. Table 5 shows the progress.

Table 5: *The Meaningful progress*

	No. of students	%
Post-test is better than Pre-test	32	78
Students in the Post-test scored 4 or more questions better than the Pre-test	16	39

Table 5 shows 32 or 78% of students make progress in their Post-test. However it might not be a meaningful result. Based on the grading percentage of Certificate Examination, 4 questions progress is used as a meaningful indicator. As a result 16 students or 39% of students can make a meaningful progress in the Post-test. We can conclude that about 40% of respondents have benefited from the ICT instruction.

Results of the Questionnaire Survey

There are 42 items in the questionnaire. All are multiple-choice questions. 41 questionnaires are distributed and 39 collected. The response rate is 95.1%. The questionnaire requires respondents to give response to the design, the effectiveness and the content of the software.

Design of the software

There are six questions in this section. The results are shown in Table 6. Table 6 shows that students' attitude towards the design of the software are positive. Over 70% of respondents find the software interesting and the photos beautiful (Questions 4 and 5). Nearly 90% of respondents understand its text as well (Question 3). However, only half of respondents claim to have full understanding to the content. It might imply that teachers, being the role of teaching are still important. Most of respondents disagree with the statement that the software can replace the textbook. In fact only half of respondents claim that the content of the software is richer than the textbook (Questions 13 and 14). The written comments basically confirm the results of the questionnaire. Most of respondents claim that teachers should play an important role in teaching and they should not be replaced.

Table 6: *Students' response rate to the design of the software*

No.	Question	Strongly		Sum of		Strongly	Sum of	Missing
		Disagree	Disagree	Disagree	Agree	Agree	Agree	
		%	%	%	%	%	%	
3	I understand the text in the software.	0	10.3	10.3	76.9	12.8	89.7	0.0
4	The software is interesting.	0	28.2	28.2	66.7	5.1	71.8	0.0
5	The software photos are beautiful.	2.6	17.9	20.5	64.1	10.3	74.4	5.1
6	I can fully understand the content of the software.	5.1	38.5	43.6	48.7	2.6	51.3	5.1
13	The content of this software is richer than the textbook.	5.1	38.5	43.6	48.7	7.7	56.4	0.0
14	The software can replace the textbook.	23.1	56.4	79.5	12.8	7.7	20.5	0.0

*Missing value refers to those question with no attempt or more than one attempts.

Effectiveness of the software

There are eight questions in this section. The results are shown in table 7. The results are quite contradictory. On one hand over 80% of respondents agree that they like the software and it would contribute to their learning of Chinese History (Questions 1 and 2). On the other hand over half of respondents do not agree with meaningful learning effect brought by the software (Questions 8, 9 and 12). It is surprising that 77% of respondents claim they will not extend their learning by borrowing relevant books!

The results in Table 6 and 7 show that respondents generally accept the adopting of this on-line software in teaching and learning of Chinese History. As the design is new and interesting, the photos are beautiful. Nevertheless, they would doubt that whether it might contribute for meaningful learning. The reasons behind are complicated and it cannot be addressed in the present paper in details. I believe that if a longitudinal research is allowed for the same batch of respondents or some in-depth interviews are conducted with the respondents, this contradictory result might be explained.

Table 7: *Students' response rate to the effectiveness of the software*

No.	Question	Strongly		Sum of		Strongly	Sum of
		Disagree	Disagree	Disagree	Agree	Agree	Agree
		%	%	%	%	%	%
1	I like this on-line learning software.	0	17.9	17.9	69.2	12.8	82
2	The software helps me to learn Chinese History.	0	17.9	17.9	74.4	7.7	82.1
7	The software can replace face-to-face teacher instruction.	20.5	59	79.5	15.4	5.1	20.5
8	The software can help me to learn Chinese History in an active way.	7.7	46.2	53.9	46.2	0	46.2
9	After this learning, my interest in learning Chinese History will be developed.	2.6	53.8	56.4	43.6	0	43.6
10	After this learning, I would borrow books relevant to the topics.	10.3	66.7	77	23.1	0	23.1
11	After this learning, I would search relevant material from the internet.	10.3	35.9	46.2	46.2	7.7	53.9
12	This software could help me to get through examination.	5.1	48.7	53.8	43.6	2.6	46.2

The Content Section

This section includes four subsections: Dr Sun and Xingzhonghui (Society to Restore

China's Prosperity), Revolutionary Activities in Tong Meng Hui (China Revolutionary League), the WuChang Uprising and the Establishment of The Republic of China. There are seven questions in each subsection. Questions in each subsection are the same. The results are shown from table 8 to table 14.

Table 8 indicates that most of respondents agree that the text of all the topics in the software is understandable. A comparatively lower response rate is the topic of the Wuchang Uprising, 10% lower than the highest response-question 22 in this group. The difference might be due to the context of the topic. The Wuchang Uprising emphasizes on the courses of the revolution in which a large quantity of data such as names of different parties and places, details of the incident has to be memorized. That might bring the text relatively incomprehensible.

Table 8: *students' response rate to the text*

No.	Question: The text is understandable.	Strongly Disagree %	Disagree %	Sum of Disagree %	Agree %	Strongly Agree %	Sum of Agree %	Missing Value %
15	Dr Sun and Xingzhonghui	0	25.6	25.6	64.1	10.3	74.4	0
22	Revolutionary activities in Tong Meng Hui	0	20.5	20.5	74.4	5.1	79.5	0
29	The Wuchang Uprising	0	25.6	25.6	61.5	7.7	69.2	5.1
36	The establishment of The Republic of China	2.6	20.5	23.1	74.4	2.6	77	0
	Average mean	0.7	23.	23.7	68.6	6.4	75	

Most of respondents agree that the content is rich in all the topics in the software. (Table 9) The topics-“Revolutionary activities in Tong Meng Hui” and “The establishment of The Republic of China” even gain nearly 80% of positive respondents.

Table 9: *students' response rate to the data*

No.	Question: The data is sufficient.	Strongly Disagree %	Disagree %	Sum of Disagree %	Agree %	Strongly Agree %	Sum of Agree %	Missing Value %
16	Dr Sun and Xingzhonghui	0	30.8	30.8	61.5	7.7	69.2	0
23	Revolutionary activities in Tong Meng Hui	2.6	17.9	20.5	69.2	10.3	79.5	0
30	The Wuchang Uprising	2.6	25.6	28.2	61.5	7.7	69.2	2
37	The establishment of The Republic of China	0	20.5	20.5	71.8	7.7	79.5	0
	Average mean	1.3	23.7	25	66	8.4	74.4	

About 70% of respondents on the whole agree with the statement “Historical

development is clear.” Among all, the topic of the Wuchang Uprising gains the highest positive respondents. It is meaningful to compare these results with table 8. On one hand students find the text of this topic- “The Wuchang Uprising”- comparatively incomprehensible, on the other hand they claim the topic with higher clarity. That means the incomprehensibility of the text does not bring much hindrance to the understanding of historical facts.

Table 10: *students’ response rate to historical development*

No.	Question: Historical development is clear.	Strongly Disagree %	Disagree %	Sum of Disagree %	Agree %	Strongly Agree %	Sum of Agree %	Missing Value %
17	Dr Sun and Xingzhonghui	0	30.8	30.8	64.1	5.1	69.2	0
24	Revolutionary activities in Tong Meng Hui	2.6	28.2	30.8	59	7.7	66.7	2.6
31	The Wuchang Uprising	0	23.1	23.1	66.7	7.7	74.4	2.6
38	The establishment of The Republic of China	2.6	28.2	30.8	56.4	12.8	69.2	0
	Average mean	1.3	27.6	28.9	61.5	8.3	69.8	

Generally, High-order thinking questions are more difficult than other types of questions such as multiple-choices questions. However, about 70% of respondents surprisingly agree that the high-order thinking questions are thought provoking. (Table 11) It seems that the software to a certain extent does support the mindful thinking.

Table 11: *students’ response rate to high-order thinking questions*

No.	Question: Questions in “High-order thinking subsection” are thought provoking.	Strongly Disagree %	Disagree %	Sum of Disagree %	Agree %	Strongly Agree %	Sum of Agree %	Missing Value %
18	Dr Sun and Xingzhonghui	0	28.2	28.2	59	10.3	69.3	2.6
25	Revolutionary activities in Tong Meng Hui	2.6	28.2	30.8	53.8	10.3	64.1	5.1
32	The Wuchang Uprising	2.6	23.1	25.7	64.1	10.3	74.4	0.0
39	The establishment of The Republic of China	0	30.8	30.8	61.5	7.7	69.2	0.0
	Average mean	1.3	27.5	28.8	59.6	9.6	69.2	

Compared with other types of questions, multiple-choices questions are normally welcomed by students. That explains the response rate shown in Table 12 is very positive. “Dr Sun and Xingzhonghui” gains nearly 90% high positive response rate.

Table 12: *students’ response rate to multiple-choices questions*

No.	Question: The level of difficulty in	Strongly Disagree	Disagree	Sum of Disagree	Agree	Strongly Agree	Sum of Agree	Missing
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	Multiple-choices questions is acceptable	Disagree %	%	Disagree %	%	Agree %	Agree %	Value %
19	Dr Sun and Xingzhonghui	0	7.7	7.7	79.5	10.3	89.8	2.6
26	Revolutionary activities in Tong Meng Hui	0	17.9	17.9	74.4	7.7	82.1	0.0
33	The Wuchang Uprising	0	17.9	17.9	76.9	5.1	82	0.0
40	The establishment of The Republic of China	2.6	23.1	25.7	64.1	5.1	69.2	5.1
	Average mean	0.6	16.7	17.3	73.7	7	80.7	

As aforementioned, extended learning is the main indicator to meaningful learning. If students are willing to extend their learning after lesson, a transformative process will be happened to those students and vice versa. An average mean of 67.2% of respondents claim that they will seek for further learning after lesson. (Table 13) Although the average response rate is the lowest compared with other results in the Content Section, over half of respondents do experience meaningful learning with the e-learning package.

Table 13: *students' response rate to extended subsection questions*

No.	Question: Questions in 'Extended Subsection' can lead me for further learning.	Strongly Disagree %	Disagree %	Sum of Disagree %	Agree %	Strongly Agree %	Sum of Agree %
20	Dr Sun and Xingzhonghui	0	25.6	25.6	69.2	5.1	74.3
27	Revolutionary activities in Tong Meng Hui	7.7	28.2	35.9	59	5.1	64.1
34	The Wuchang Uprising	5.1	23.1	28.2	66.7	5.1	71.8
41	The establishment of The Republic of China	2.6	38.5	41.1	53.8	5.1	58.9
	Average mean	3.8	28.7	32.7	62.1	5.1	67.2

More than half of respondents agree that prompts and analyzes in the "Concluding Section" are adequate and it could contribute to their learning. The topic of the "Wuchang Uprising" gets the lowest positive response rate; with a high strongly disagree rate, we might speculate that learning is not very effective in this topic.

Table 14: *students' response rate to concluding subsection questions*

No.	Question: Prompts and analyzes in the 'Concluding Subsection' are adequate and it could contribute to my learning.	Strongly Disagree %	Disagree %	Sum of Disagree %	Agree %	Strongly Agree %	Sum of Agree %	Missing Value %
21	Dr Sun and Xingzhonghui	0	17.9	17.9	64.1	17.9	82	0
28	Revolutionary activities in Tong Meng Hui	0	25.6	25.6	66.7	5.1	71.8	2.6
35	The Wuchang Uprising	7.7	33.3	41	51.3	7.7	59	0
42	The establishment of The Republic of China	5.1	28.2	33.3	64.1	2.6	66.7	0

Average mean	3.2	26.2	29.4	61.5	8.3	69.8	
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To sum up, the respondents are generally satisfied with the content of the software. Table 15 shows an average mean of the results short-listed from table 8 to 14. About 75 to 80% of respondents in tables 8, 9 and 12 show their positive attitudes. Tables 10, 11, 13 and 14 gets nearly 70% positive response rate as well. It is no doubt that students are satisfied with the extrinsic value of the learning package, i.e. the text, the photos and the interactive nature of ICT (see results of table 6 and 7). Regarding to the intrinsic value of the package, i.e. contribution for further learning, students' responses are not completely positive. As mentioned before, though 67.275% of respondents claim for further learning (table 13); if further actions require, the response rate drops tremendously to 23.1% (borrowing relevant books) and 53.9% (searching relevant material from the Internet).

Table 15: Average mean of questions in Content Section (Table 8 to 14)

Table	Strongly		Sum of		Strongly	Sum of
	Disagree	Disagree	Disagree	Agree	Agree	Agree
	%	%	%	%	%	%
Table 8-text	0.7	23.	23.7	68.6	6.4	75
Table 9-data	1.3	23.7	25	66	8.3	74.3
Table 10-historical development	1.3	27.5	28.8	61.5	8.3	69.8
Table 11-high-order questions	1.3	27.5	28.8	59.6	9.7	69.3
Table 12-multiple-choices questions	0.6	16.7	17.3	73.7	7	80.7
Table 13-extended subsection	3.9	28.8	32.7	62.1	5.1	67.2
Table 14-concluding subsection	3.2	26.2	29.4	61.5	8.3	69.8

The written comments of respondents in the questionnaires confirm our argument. There are 21 responses to this item on the questionnaire. 18 out of 21 show his/her attitude either towards the software or the mode of teaching design in the research lessons. Among 18 comments, five could be regarded as positive while 8 as negative. Some positive responses are "Very special, quite interesting", "I think the software is rich in content and understandable", "It's good. It could contribute to Chinese History learning". The dominant comments however, are negative. Some typical responses are: "Information and facts are not enough", "Content is not rich", "Time is not enough", "Teaching by teachers in the classroom is better than learning from the Internet".

With the discussion on the results of Pre- and Post- tests and the results of the questionnaire survey, we have the following conclusions:

1. 32 or 78% of respondents could have progress in the Post-test. The findings alone cannot support a positive relationship between high performances in the Post-test with the use of ICT.
2. If using the public Certificate Examination as reference, 16 or 39% of respondents make real progress in the Post-test. This progress is significant both statistically and educationally. Therefore we have more confidence to argue that effective learning have been seen in these 39% respondents.
3. Reflecting from the results of the questionnaire, students' interests have been aroused and motivation improved. However, the transformation from motivation to meaningful learning is not apparent. There is no concrete evidence that respondents would extend their learning after the research lessons.

Conclusion

Could a class of Secondary Four Chinese History students achieve meaningful learning with the introduction of ICT to lessons? The answer depends on how one interprets the notion of "meaningful learning". Echoing with Passey's comments to the introduction of ICT to the classroom, which is presented in the onset of the present paper, students' interests are aroused and motivation improved. Nevertheless, if we argue that willingness to seek for further learning in future is a successful indicator for meaningful learning, the results and findings of the present paper do not completely go with the argument. A weak argument does not mean that ICT use could not contribute to meaningful learning. I argue that there are several limitations of the study that hinder the use of ICT to extend its full function.

First, as aforementioned, subsequent action is a main process in an action research. Therefore, the inadequacy of the ICT should not be concluded unless comparison made with further action researches.

The second limitation relates to the nature of Chinese History as a subject. Senior class Chinese History is bounded by the public examination syllabus. It is characterized by data and information oriented, emphasizing on memorization instead of analytical thinking. It is hard to distinguish whether some of the negative attitudes come from the ICT use or the subject itself. A possible solution would be to select a control group as comparison or to extend the research period so that some variables such as attitudes towards the subject could be identified and controlled.

The third limitation is reflected from the written comments of the respondents. Some comments prefer teaching by teachers in the classroom rather than learning by themselves from the software and the Internet. These comments indicate that students might benefit more

with a combination of methods of teaching. That would probably be the direction of further researches.

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