# A Study of Mathematics E-Textbook Usage in Hong Kong Primary School

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**Abstract**

In this study, it describes the overview of the e-Textbook Market Development Scheme in Hong Kong. An experiment was conducted in a Primary school in Hong Kong, which the participants are 2 classes of Primary 4 students who studies Mathematics with printed textbook (n=22) and e-textbook (n=31) respectively. The class studied with printed textbook served as the control group, while the class studied with e-textbook served as the experimental group. The intervention of this study is the change of mode in studying mathematics – change from studying printed textbook to e-textbook in the experimental group. Their Mathematics tests result of the first and second standardize test were collected for further analysis. The findings in the report shows that using e-textbook rather than printed textbook to study Primary Mathematics can help to improve the overall examination result of students, in particular, help to improve their test results on dimensions "N" (Number) and "M" (Measures). The result also suggests that improvements are more significant in girls when compare with boys.

*Keywords:* e-learning, e-textbook, mathematics education, primary school

## 1. Introduction

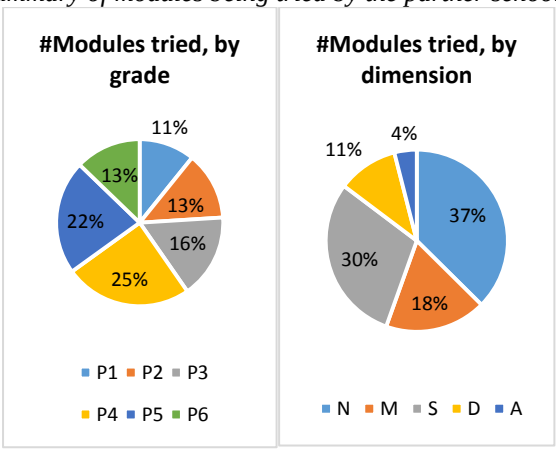
In 2012, the HKSAR government launched the e-Textbook Market Development Scheme (EMADS). The scheme aims to facilitate and encourage the participation of e-textbook developers to develop e-textbooks in line with the local curricula, which the e-textbook can hopefully be listed on the Recommended Textbook List for e-textbooks (e-RTL).

There were 50 sets of e-textbook which successfully applied for EMADS. The e-Learning Development Laboratory from the University of Hong Kong is one of the EMADS developers in Primary Mathematics. They have developed a set of e-textbook, which was written in Chinese, for both key stage 1 (Primary 1-3) and key stage 2 (Primary 4-6). The e-textbook covered all the 83 modules defined from the "Mathematics Education Key Learning Area - Mathematics Curriculum Guide (P1-P6)" (2000). The e-textbook was approved by the Education Bureau in December 2015, which is currently the only approved e-textbook in Primary Mathematics.

In order to promote e-textbook to schools in Hong Kong effectively, the HKU e-Learning Lab introduced a "Primary Mathematics e-Textbook Partner School Programme" in academic year 2015-16. In this programme, the HKU e-Learning Lab provided free e-textbook usage, technical support and training of using e-textbook to schools, teachers, as well as students. The Lab also organized some open classes an sharing sessions to promote e-textbook to the public. Data on comparing different attributes and outcomes of the printed textbook and e-textbook were collected by the means of class observations and tests. The collected data was compared and analyzed and check if there are any correlations between the effectiveness of teaching and learning when comparing using printed textbook and e-textbook, and the acceptance of adopting e-textbook.

There were 51 primary schools registered to join the partner school programme. A total count of 704 modules were tried by those 51 schools. Out of those 704 modules being tried by the partner schools, the summary is shown as below:

Chart 1
*Summary of modules being tried by the partner schools*




*Note.* There are 5 dimensions in Primary Mathematics suggested in the curriculum – Number (N), Measures (M), Shape and space (S), Data Handling (D) and Algebra (A).

From the Chart above, we can see that the majority of the schools would like to try e-textbook for Primary 4 (25%) and Primary 5 (22%) students. Moreover, more schools would like to try e-textbook for "Number" (37%) and "Shape and Space" (30%). One of the partner school was selected as the school to be focused on this study.

### 1.1 E-textbook / e-learning on Mathematics

In general, researchers suggested that primary and secondary schools adopted in a top-down approach (Frydenberg, & Markin, 2007; Wang, Lin, & Lee, 2011). In Hong Kong, the way a school to adopt textbook / e-textbook is made by principals and subject panel heads, and this is compulsory for all subject teachers once it is decided (Chiu, 2016). On the other hand, the adoption for non-daily technologies are not compulsory for teachers, for instance, mobile learning and learning management system (Chiu, & Churchill, 2015; Hargreaves, & Shirley, 2011). This is due to schools is more care about the content, or the curriculum. The schools leave the freedom to the subject teachers to decide the means to delivered the content.

According to some researches in the Europe, studying Mathematics requires understanding the relations between different new concepts and learners' existing knowledges, which is one of the greatest challenges for studying Mathematics, which a good way is to overcome this challenge is to motivate students to use e-textbook in the classroom and at home (Pesek, et al., 2014). Another research in Turkey suggested that, there were significant improvement in learning attitudes when comparing after and before the course, which learners were studying mathematics at Karadeniz Technical University (Ö ngöz, & Baki, 2011).

### 1.2 Mathematical dimensions in Hong Kong Primary Mathematics curriculum

The mathematics curriculum in Hong Kong is designed as a spiral curriculum, the curriculum consists of 5 mathematical dimensions, which include number (N), measures (M), shape and space (S), data handling (D) as well as algebra (A). According to chapter 3 – Curriculum Structure of "Primary Maths Curriculum 2000", dimension "N" refers to contents in whole number, nature of number, fractions, decimals & percentages, as well as calculating devices. Dimension "M" refers to contents in money, length, time, weight, capacity, perimeter, area, volume and speed. Dimension "S" refers to contents in three dimensional shapes, lines, two dimensional shapes, angles and directions. dimension "D" refers to contents in statistics. Dimension "A" refers to contents in algebraic symbols and equations.

### 1.3 Gender differences in learning Mathematics

Mathematics are often stereotyped as male-domain (Nosek, et al., 2009; Hyde, et al., Frost, & Hopp, 1990; Fennema & Sherman, 1977). According to a research in Norway, the result from TIMSS and PISA showed that boys generally score higher than girls in mathematics (Wedege, 2007). Similar result was suggested by another research in Australia – boys in Grade 4 (equivalent to Primary 4 in Hong Kong) and Grade 8 (equivalent to Secondary 2 in Hong Kong) scored higher than girls in the respectively grades on TIMSS 1995-2007 (Forgasz, 2015). On the other side of the world, TIMSS data suggested that there were statistical significant mathematics scores differences between boys and girls in the U.S., too – Boys got higher scores than girls (Mullis, et al., 2008). Boys in the U.S. remained more confident of their mathematics abilities when compare to girls with same test score (Correll, 2001). According to another study in Singapore, gender differences were found in mathematics achievement – In general, boys performs better than girls, but girls viewed their classroom environments more favorably than boys did (Goh, & Fraser, 1998).

## 2. Statement of Research Problem

In recent years, e-learning and e-textbook technologies have been developed in lightning speed. In early stage, textbook publishers developed e-content in CD-ROMs, which was bundled with their printed textbook, usually for free. Users may enjoy reading the e-content with a computer which has a CD-ROM drive installed on it. Sometimes later, textbook publishers developed web-based content, which included textbooks, exercises, question bank, teaching resources for teachers, etc, which were delivered in a form of a website. Textbook publishers provided free accounts to the schools which purchased their textbooks. These changes, or enhancements were also aligned with suggestions by some other researchers - (1) the move from comprehensive software packages to small, expressiveness, web applets; (2) the move towards mobile, touch-based interface; and (3) the changes in web and social technology (Sinclair, & Yerushalmy, 2016). Nowadays, textbook publishers start developing e-textbook, which is a self-contained system which allows users to access in any mobile devices or computers with different operating systems. For now, the adoption rate of using e-textbook in class is still a minority, it is still a transition period for schools to migrate from textbook to e-textbook, as they may still have doubts on whether e-textbook can finally replace printed textbook in the future.

E-textbook has been developed in different regions, such as the United States, Taiwan and South Korea. For instance, in South Korea, one of the early adopters of e-textbook, was supported by government policy when promoting e-textbook to its region. The South Korean digital textbook publishers needed to develop e-textbooks based on the curriculum suggested by the Ministry of Education in South Korea, which is similar to the case in Hong Kong. Moreover, the government of Florida, the United States also provides financial subsidies on printed textbooks to a digital format, and assists school districts to evaluate the materials, which is also similar to the case in Hong Kong EMADS.

Starting from 2012, the government tried to promote e-textbook to schools. However, there are uncertainties on the effectiveness when using e-textbooks for teaching and learning, including reading speed or duration, pre-test and post-test result of the students, the lesson preparation time for teachers, the revision time of

students, whether the students understand the content, etc. These may affect the overall acceptance of adopting e-textbook among students, teachers or parents, which may eventually make this policy from the government failed.

This project focused on the proposed study in Primary Mathematics in Hong Kong only. Further researches can be done on other subjects such as languages study or other STEM subjects, and in different academic levels and regions.

### 2.1 Research Questions

1. Does study Primary Mathematics with printed textbook or e-textbook affect the overall mathematics examination result?
2. Does study Primary Mathematics with printed textbook or e-textbook affect the examination result among different mathematical dimensions?
3. Does study Primary Mathematics with printed textbook or e-textbook affect the examination result among different gender?

## 3. Methods

In this study, 2 Primary 4 classes were selected in Fung Kai No. 1 Primary School as the participants. One of the classes used e-textbook in their Mathematics lessons after the first test, while the other class used original textbook in their Mathematics lessons as the control group. The result of the first and the second test were collected for further analysis. Since the aim of this report is to test if using e-textbook affects the examination result, the data collected was the examination result for each participant, breakdown in different mathematical dimensions. The data is measurable. As a result, this study was designed as a quantitative experimental research. Microsoft Excel and IBM Statistics SPSS had been used as the data analytic tools of this project. Varies tests were conducted and the results will be reported in later sessions.

### 3.1 Research design

For this e-textbook study, it was designed as a quantitative experimental research. Since there is a control group in this study, and the classes are not randomly assigned, so, it is a Quasi-experiment design. This design is referred from another case study in Europe, which is for Mathematics i-textbook in K-12 education. This case study was conducted by a group of researchers in University of Maribor (Lipovec, et al., 2014). The research presented the results of some pedagogical experiments evaluating Mathematics e-textbook in primary school level. The mathematical topics are categorized into 4 areas – arithmetic, geometry, measurements and data processing, which is similar to those in Hong Kong Primary Mathematics education. In this European study, test results were collected from the control group and the experimental group for further analysis. As mentioned in previous part of this report, the timeline for academic year 2015/16 which Class A (the control group) and Class B (the experimental group) studied Mathematics is shown as below:

Although the printed textbook and e-textbook was not published by the same publishers, both the printed textbook and e-textbook were assessed by the Education Bureau and got approved to the Recommended Textbook List (RTL) and Recommended E-Textbook List (e-RTL) respectively, the book content was developed based on the Primary Mathematics Curriculum. As a result, the learning objectives of the Mathematics modules must be the same. However, in the early stage of the study, it was not clear whether the learning abilities between Class A and Class B are similar or not. In order to make the results of this quantitative research more accurate and convincing, a set of pre-test and post-test was carried out – first Mathematics standardize test as the pre-test while the second Mathematics standardize test as the post-test.

The purpose of the pre-test was to check the existing knowledge of the participants. The same test was given to both Class A and Class B, both given the same time to finish the test. A post-test was suggested to be conducted after the student finish learning the proposed mathematics modules. The purpose of the post-test is to check the level of understanding of the participants in the selected modules. Again, the same test shall be given to both Class A and Class B.
The tests were designed by the teachers in the experimental schools, which the research team did not have any influence on what kind of questions were set in the tests, such that the collected results were not biased.

### 3.2 Participants

As mentioned in early part of this report, the target participants are 2 classes of primary 4 students in Fung Kai No.1 Primary School, who study mathematics with Chinese language. Their test results were collected in an anonymous basis. For the first class, we name it as class A, is the class which used printed textbook in their mathematics lessons. There were 35 students in this class, while 22 of them agreed to participate in this study. Moreover, their parents also agreed us to collect the test result data from their child. Out of these 22 participating students, 12 of them are boys and 10 are girls.

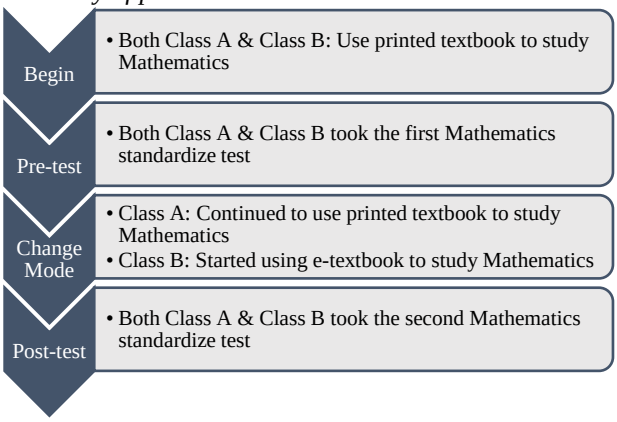
For the second class, we name it as class B, is the class which used e-textbook after their first mathematics standardize test. Before the first test, they also use printed textbook in their Mathematics lessons. This class was a BYOD (Bring your own device) e-learning class, while the students used tablet PCs (in specific, iPad) for almost all of their lessons (included subjects apart from Mathematics). There were 34 students in this class, while 31 of them agreed to participate in this study. Also, their parents agreed us to collect the test

result data from their child. Out of these 31 participating students, 15 of them are boys and 16 are girls respectively.

### 3.3 Procedures

The participants in both Class A and Class B took the pre-test and post-test just like they had an ordinary Mathematics standardize tests before, without anything extra or different. The procedures of this study can be summarized as follow:

Figure 2
*Summary of procedures*




### 3.4. Data Collection

The results for first and second Mathematics standardize test for both Class A (the control group) and Class B (the experimental group) were collected. 22 sets of test paper from Class A, as well as 31 sets of test paper from Class B were collected and scanned. The score for each question was collected and input to a spreadsheet for further analysis.

## 4. Measures

As mentioned in previous section of this report, the curriculum consists of 5 mathematical dimensions, which include number (N), measures (M), shape and space (S), data handling (D) as well as algebra (A). In Hong Kong, students start learning algebra from Primary 5. So, in this study, the dimension "A" was not considered.

For the pre-test, there are all together 45 questions and the total score is 100, which dimension "N" has 50 marks, dimension "M" has 18 marks, dimension "S" has 24 marks and dimension "D" has 8 marks. The time allow for this test is 45 minutes. For the full paper, please refer to Appendix II.

For the post-test, there are all together 45 questions and the total score is 100, which dimension "N" has 52 marks, dimension "M" has 20 marks, dimension "S" has 18 marks, dimension "D" has 10 marks. The time allow for this test is also 45 minutes. For the full paper, please refer to Appendix III.

The summary of the mark allocation on pre-test and post-test is as follow:

Table 1
*Mark allocation on pre-test and post-test*

| Test | N | M | S | D | A* | Total |
|---|---|---|---|---|---|---|
| Pre-test | 50 | 18 | 24 | 8 | 0 | 100 |
| Post-test | 52 | 20 | 18 | 10 | 0 | 100 |

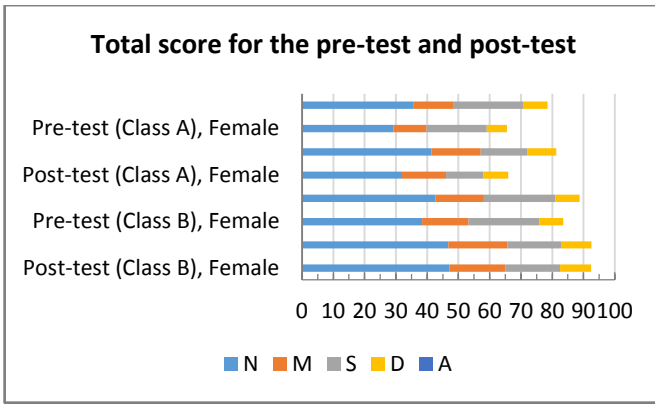
*Note.* * Students in Hong Kong start learning algebra from Primary 5

## 5. Results

The data collected from the pre-test and post-test was grouped into different domains: pre-test vs. post-test; control group vs. experimental group; male vs. female. The average of their test scores were breakdown according to the 5 mathematical dimensions. The results showed that for Class A, the average of the test results for the pre-test (72.55) and post-test (74.32) are more or less the same, while for Class B, the test results for the pre-test (86.03) and post-test (92.45) has a more significant improvement. The summary of the data collected is shown as below:

Table 2
*Total score for the pre-test and post-test, group by the 5 mathematical dimensions*

| Test (Class) | N | M | S | D | A | Total |
|---|---|---|---|---|---|---|
| **Pre-test (Class A)** | **32.68** | **11.82** | **20.86** | **7.18** | **0** | **72.55** |
| Male | 35.58 | 12.92 | 22.17 | 7.83 | 0 | 78.50 |
| Female | 29.20 | 10.50 | 19.30 | 6.40 | 0 | 65.40 |
| **Post-test (Class A)** | **37.05** | **15.05** | **13.55** | **8.68** | **0** | **74.32** |
| Male | 41.33 | 15.75 | 14.92 | 9.33 | 0 | 81.33 |
| Female | 31.90 | 14.20 | 11.90 | 7.90 | 0 | 65.90 |
| **Pre-test (Class B)** | **40.52** | **15.10** | **22.81** | **7.61** | **0** | **86.03** |
| Male | 42.73 | 15.47 | 22.80 | 7.73 | 0 | 88.73 |
| Female | 38.44 | 14.75 | 22.81 | 7.50 | 0 | 83.50 |
| **Post-test (Class B)** | **46.97** | **18.45** | **17.23** | **9.81** | **0** | **92.45** |
| Male | 46.80 | 18.93 | 17.07 | 9.73 | 0 | 92.53 |
| Female | 47.13 | 18.00 | 17.38 | 9.88 | 0 | 92.38 |




### 5.1 Variables

The raw data was converted into 12 variables from Microsoft Excel, which were then input to IBM Statistics SPSS for further analysis:

Table 3
*List of variables*

| Name | Description | Measures | Range |
|---|---|---|---|
| Class | The class which the participants from | Nominal | A or B |
| Gender | The gender of the participants | Nominal | M or F |
| PretestTotal Score | Pre-test total score | Scale | 0 – 100 |
| PosttestTotalScore | Post-test total score | Scale | 0 – 100 |
| PretestN | Pre-test percentage score on "N" | Scale | 0 – 1 |
| PretestM | Pre-test percentage score on "M" | Scale | 0 – 1 |
| PretestS | Pre-test percentage score on "S" | Scale | 0 – 1 |
| PretestD | Pre-test percentage score on "D" | Scale | 0 – 1 |
| PosttestN | Post-test percentage score on "N" | Scale | 0 – 1 |
| PosttestM | Post-test percentage score on "M" | Scale | 0 – 1 |
| PosttestS | Post-test percentage score on "S" | Scale | 0 – 1 |
| PosttestD | Post-test percentage score on "D" | Scale | 0 – 1 |

## 6. Data Analysis

In this report, the data was input to IBM SPSS Statistics (Version 22) and conducted respective tests.

### 6.1. The difference between the pre-test and post-test result of Class A

A paired-sample t-test was conducted to compare the difference between the pre-test and post-test result of Class A. There were no significant results for the total score, dimensions "M" and "D" among the pre-test than the post-test. However, there was a significant higher scores among dimension "N" in the post-test (M=.712, SD=.168) than the pre-test (M=.654, SD=.126); (t(21)=-2.203, p=.039). There was also a significant lower scores among dimension "S" in the post-test (M=.753, SD=.293) than the pre-test (M=.869, SD=.140); (t(21)=2.493, p=.021).

Table 4
*Means and standard deviations of the pre-test and post-test results of Class A*

| Measure | Pre-test (n=22) | | Post-test (n=22) | | | |
|---|---|---|---|---|---|---|
| | M | SD | M | SD | t-Value | p |
| Total | 72.54 | 12.26 | 74.31 | 15.55 | -.889 | .384 |
| N | .654 | .126 | .712 | .168 | -2.20* | .039 |
| M | .657 | .197 | .752 | .152 | -1.95 | .064 |
| S | .869 | .140 | .753 | .293 | 2.49* | .021 |
| D | .898 | .148 | .868 | .189 | .900 | .379 |

*Note.* * p<.05

### 6.2 The difference between the pre-test and post-test result of Class B

A paired-sample t-test was conducted to compare the difference between the pre-test and post-test result of Class B. There was a significant higher total score among the post-test (M=92.452, SD=5.824) than the pre-test (M=86.032, SD=5.941); (t(30)=-4.356, p=.000). There was also a significant higher scores among dimension "N" in the post-test (M=.903, SD=.080) than the pre-test (M=.810, SD=.097); (t(30)=-4.073, p=.000). Moreover, there was a significant higher scores among dimension "M" in the post-test (M=.923, SD=.074) than the pre-test (M=.839, SD=.094); (t(30)=-4.550, p=.000). However, there were no significant results for the dimensions "S" and "D" among the pre-test and the post-test.

Table 5
*Means and standard deviations of the pre-test and post-test results of Class B*

| Measure | Pre-test (n=31) | | Post-test (n=31) | | | |
|---|---|---|---|---|---|---|
| | M | SD | M | SD | t-Value | p |
| Total | 86.03 | 5.94 | 92.45 | 5.82 | -4.35*** | .000 |
| N | .810 | .097 | .903 | .080 | -4.07*** | .000 |
| M | .839 | .094 | .923 | .096 | -4.55*** | .000 |
| S | .950 | .062 | .957 | .074 | -.420 | .677 |
| D | .952 | .089 | .981 | .060 | -1.38 | .175 |

*Note.* *** p<.001

### 6.3. The difference between the pre-test result and pro-test result of Class A (Male)

A paired-sample t-test was conducted to compare the difference between the pre-test result and post-test of Class A (Male). There was a significant higher score on dimension "N" among the post-test (M=.795, SD=.099) than the pre-test (M=.712, SD=.097); (t(11)=-2.959, p=.013). However, there were no significant results for the total score, dimensions "M", "S" and "D" among the pre-test and the post-test.

Table 6
*Means and standard deviations of the pre-test and post-test results of Class A (Male)*

| Measure | Pre-test (n=12) | | Post-test (n=12) | | | |
|---|---|---|---|---|---|---|
| | M | SD | M | SD | t-Value | p |
| Total | 78.50 | 7.76 | 81.33 | 8.45 | -1.09 | .298 |
| N | .712 | .097 | .795 | .099 | -2.95* | .013 |
| M | .718 | .163 | .788 | .096 | -1.14 | .275 |
| S | .924 | .090 | .829 | .250 | 1.51 | .158 |
| D | .979 | .072 | .933 | .130 | 1.00 | .339 |

*Note.* * p<.05

**6.4. The difference between the pre-test result and pro-test result of Class B (Male)**

A paired-sample t-test was conducted to compare the difference between the pre-test result and post-test of Class B (Male). There was a significant higher score on dimension "M" among the post-test (M=.947, SD=.064) than the pre-test (M=.859, SD=.089); (t(14)=-3.288, p=.005). However, there were no significant results for the total score, dimensions "N", "S" and "D" among the pre-test and the post-test.

Table 7

*Means and standard deviations of the pre-test and post-test results of Class B (Male)*

| Measure | Pre-test (n=15) | | Post-test (n=15) | | | |
|---|---|---|---|---|---|---|
| | M | SD | M | SD | t-Value | p |
| Total | 88.73 | 4.99 | 92.53 | 4.79 | -1.89 | .079 |
| N | .855 | .075 | .900 | .075 | -1.51 | .152 |
| M | .859 | .089 | .947 | .064 | -3.28* | .005 |
| S | .950 | .059 | .948 | .083 | .061 | .952 |
| D | .967 | .057 | .973 | .070 | -.257 | .801 |

*Note.* * p<.05

**6.5. The difference between the pre-test result and pro-test result of Class A (Female)**

A paired-sample t-test was conducted to compare the difference between the pre-test result and post-test of Class A (Female). There were no significant results for the total score and all the 4 mathematical dimensions.

Table 8

*Means and standard deviations of the pre-test and post-test results of Class A (Female)*

| Measure | Pre-test (n=10) | | Post-test (n=10) | | | |
|---|---|---|---|---|---|---|
| | M | SD | M | SD | t-Value | p |
| Total | 65.40 | 13.16 | 65.90 | 18.23 | -.157 | .879 |
| N | .584 | .125 | .613 | .183 | -.612 | .556 |
| M | .583 | .218 | .710 | .197 | -1.54 | .157 |
| S | .804 | .164 | .661 | .326 | 1.95 | .083 |
| D | .800 | .158 | .790 | .223 | .205 | .842 |

**6.6. The difference between the pre-test result and pro-test result of Class B (Female)**

A paired-sample t-test was conducted to compare the difference between the pre-test and post-test result of Class B (Female). There was a significant higher total score among the post-test (M=92.375, SD=6.811) than the pre-test (M=.769, SD=.087); (t(15)=-4.402, p=.001). There was also a significant higher scores among dimension "N" in the post-test (M=.906, SD=.087) than the pre-test (M=.810, SD=.097); (t(15)=-4.438, p=.000). Moreover, there was a significant higher scores among dimension "M" in the post-test (M=.900, SD=.115) than the pre-test (M=.819, SD=.098); (t(15)=-3.051, p=.008). However, there were no significant results for the dimensions "S" and "D" among the pre-test than the post-test.

Table 9

*Means and standard deviations of the pre-test and post-test results of Class B (Female)*

| Measure | Pre-test (n=16) | | Post-test (n=16) | | | |
|---|---|---|---|---|---|---|
| | M | SD | M | SD | t-Value | p |
| Total | 83.50 | 5.76 | 92.37 | 6.81 | -4.40*** | .001 |
| N | .769 | .087 | .906 | .087 | -4.43*** | .000 |
| M | .819 | .098 | .900 | .115 | -3.05** | .008 |
| S | .951 | .067 | .965 | .067 | -1.13 | .275 |
| D | .938 | .112 | .988 | .050 | -1.54 | .142 |

*Note.* ** p<.01; *** p<.001

## 7. Discussion

Refer to the result, from Table 5, there was a highly significant improvement in the overall results when comparing the post-test over the pre-test of the experimental group (Class B). On the other side of the coin, Table 4 showed that there was no significant difference when comparing the overall results between the pre-test and the post-test of the control group (Class A). The intervention applied to the experimental group of this study was, the change in mode in studying mathematics – study with e-textbook instead of printed textbook. This may due to students enjoy and prefer using e-textbooks to traditional textbooks (Weisberg, 2011; de Oliveira, et al., 2014). Our empirical results suggest that studying Primary Mathematics with e-textbook do have a positive effect when comparing to using printed textbook – improve in overall Mathematics examination result. The result also inline with another experimental research conducted in the U.S. which identified the impact of e-learning on student learning outcomes in primary and secondary schools. Findings identified was, students who used computer tutorial in mathematics scored significantly higher on tests when compared to students who did not use computers to study, or using traditional learning methods (Kulik, 2003; Annie Kavitha, & Sundharavadivel, 2012). Similar findings were found in University-level Mathematic courses, too. A recent study in Universities in the U.S. also suggested that there were significant improvements in examination scores, project scores and overall grade in Mathematics courses when static textbooks were replaced by interactive textbooks (Edgcomb, et al., 2015).

The overall result can further breakdown into different mathematical dimensions. From Table 5, there were highly significant improvements in the pre-test of the experimental group, while there were no significant differences on dimensions "S" and "D". From Table 4, there were significant improvement in the results on dimensions "N" and "S" when comparing the post-test over the pre-test of the control group, while there were no significant differences on dimensions "M" and "D". Our results suggest that studying Primary Mathematics with e-textbook do have a positive effect when comparing to using printed textbook – improve in examination result in dimensions "N" and "M".

Besides the overall results and the breakdown result of different mathematical dimensions, the result can also be discussed in another domain – gender. The result for the male participants in the experimental group may first be considered. From table 7, there were no significant differences on the overall result, as well as the results for dimensions "N", "S" and "D" when comparing the post-test over the pre-test of the male participants in the experimental group, while there is a slightly significant improvement in dimension "M". On the other hand, from Table 6, there were no significant differences on the overall result as well as the results for dimensions "M", "S" and "D" when comparing the post-test over the pre-test of the male participants in the control group, while there is a slightly significant improvement in dimension "N". Our results suggest that studying Primary Mathematics with e-textbook rather than printed textbook do not have any obvious positive or negative effect on the examination results.

Furthermore, beside the male participants, Table 8 and 9 showed the results from the female participants for the control group and the experimental group respectively. From Table 9, there were highly significant improvements for the female participants from the experimental group in the overall results as well as on dimension "N" when comparing post-test against pre-test, and there was a significant improvement in dimension "M", while there were no significant differences for dimension "S" and "D". For the female participants in the control group (Table 8), there were no significant differences in the overall results and the 4 mathematical dimensions when comparing post-test against pre-test. Our empirical results suggest that girls studying Primary Mathematics with e-textbook do have a positive effect when comparing to using printed textbook – improve in overall Mathematics examination result, as well as result in dimensions "N" and "M".

Our result regarding the gender differences also inline with another study in India. A study in India also showed that the improvement in overall Mathematics examination result of girls is more significant than boys' after studying Mathematics with e-learning resources (Annie Kavitha, & Sundharavadivel, 2012).

## 8. Conclusion

Overall, the findings showed that using e-textbook rather than printed textbook to study Primary Mathematics can help to improve the overall examination result of students, and also help to improve their results on dimensions "N" and "M". The improvements are more significant in girls when compare with boys. This study affords the following suggestions to a school which have hesitations to use e-textbook instead of printed textbook in Primary Mathematics. First, using e-textbook does not have a negative effect on students to understand the mathematics content, which can be shown by the improvement on examination results. In fact, there is a positive effect on the overall result, as well as dimensions "N" and "M". Second, teachers can keep track on the learning progress of students, which can help teachers to know more about their students before the examination.

Last but not least, the objective on developing e-textbook is not to replace printed textbook. Instead, they can work well together – e-features in the e-textbook can help students to understand more on some abstract ideas, such as 3-dimension shapes, algebraic equation, etc, while student can study with printed or e-textbook. Textbook or e-textbook are just the means for learning, the way on how the book can attract or motivate students to learn shall be the main focus.

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