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A Meta Analysis: The Effectiveness of E-Schoolbag Use on Students' Academic Achievement in China

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Abstract: This meta-analysis examines the effects of E-Schoolbag use on students' academic achievement in China. From the previous studies data, the researcher calculated the overall, average effect size on students' academic achievement, and analysis the effect in different subject and school level. The result of this study is as follows: the overall, average effect size of E-Schoolbag use to be 0.433, which is a small-to-medium effect size; The effect of E-Schoolbag varies from subject and school level. These findings indicate that E-Schoolbag have a positive effect on student learning to some extent. To improve the effect of E-Schoolbag, government, school and teachers should continue promote the integration of E-Schoolbag in the classroom.

Keywords: E-Schoolbag, Academic Achievement, Meta-Analysis

1. Introduction

With the rapid development of information technology and the popular of one to one digital learning, many digital learning tools have been developed to support students' mobile learning and ubiquitous learning. Many countries also have released policies, launched programs and improved investment to encourage and support schools to create mobile learning and ubiquitous learning environments, like the one to one iPad Program in American, the Digital Textbook's Commercialization Plan in South Korean. In China, schools use the Electronic Schoolbag (E-Schoolbag) to create the personal learning environment in the classroom for students.

E-Schoolbag is an important digital learning tool in the process of advancing and developing educational informatization in China. It is not a simple electronic material of traditional textbooks, but a personal learning environment that integrates electronic textbook learning resources, electronic textbook readers, virtual learning tools, digital learning terminals and connected ubiquitous learning services (Zhu & Yu, 2011). Now, E-Schoolbag has been widely used in Chinese primary and secondary school students' classroom learning. However, the effect of using E-Schoolbag for learning is still difficult to define and the effect of using E-Schoolbag for learning is still have a debate. The purposes of this study are to examine how much influence the E-Schoolbag has on students' academic achievement. At the same time, this study also considers the degree of E-Schoolbag' impact on the student's academic achievement when E-Schoolbag are applied to different subjects and different school levels. According to research result, we can find out the impact level of E-Schoolbag on student learning and draw some suggestions for the E-Schoolbag's effective application in Chinese schools.

2. Research Methods

This study uses the method of meta-analysis to analysis 20 primary pilot studies of the effectiveness research of E-Schoolbag Use on Students' learning. All those previous studies contain 33 effect size. The literature sample mainly search from those database, such as CNKI, Web of Science, Springer. The research topic of those samples should be the effect of E-Schoolbag in learning. And all those literature samples should consist of complete study data. This study used the Comprehensive Meta-Analysis (CMA) software to calculate all the effect size. After entering the data above, the CMA software automatically calculates the overall average effect size of all the studies. The standardized mean

difference (Cohen's d) is used to describe the size of the effect, Cohen (1988) developed it for statistical analysis. The value of d is calculated as follows:

$$d = \frac{Xe - Xc}{sd} \qquad sd = \sqrt{\frac{(n_e - 1)s_e^2 + (n_c - 1)s_c^2}{n_e + n_c - 2}}$$

Xe means the experimental group, Xc means the control group, sd is standard deviation. n_e is the sample size of the experimental group, and n_c is the sample size of the control group.s_e is the standard deviation of the experimental group, s_c is the standard deviation of the control group.

3. Results

The E-Schoolbag overall analysis result of the 20 articles selected for this study can be seen in Table 1. The overall, average effect size of E-Schoolbag is d=0.433. According to Cohen's (1988) interpretation of effect size, when d is less than or equal to 0.2, it is considered to have a small influence. When d is greater than or equal to 0.5, it is considered to have moderate influence. When d is greater than or equal to 0.8, it is considered to have very significant influence. The result means that the E-Schoolbag have a positive effect on student learning to some extent, but is slightly lower than the medium effect.

Table 1. E-Schoolbag 's Overall Average Effect Size on Academic Achievement

Model	n	Effect size and 95% confidence interval			Test of null (2-Tail)	
		d	Lower limit	Upper limit	Z-value	P-value
Random	38	0.433	0.351	0.514	10.404	<0.001

The E-Schoolbag have been used in many subjects, both traditional subjects (Chinese, Math and English) and other subjects, such as science, geography and biology etc. As we can see from Table 2, the promotion effect of E-Schoolbag on mathematics, geography and biology is small, the value of d is between 0.3 and 0.4. The promotion of Chinese and English learning is moderate, the value of d is greater than 0.5. The promotion of science is significant, the value is greater than 0.8. But the effect of science should be interpreted cautiously because the number of ESs is small.

Table 2. E-Schoolbag 's Effect Size on Academic Achievement by Subject

subject	n	Effect size and 95% confidence interval			
		d	SE	Lower limit	Upper limit
Chinese	6	0.593	0.108	0.381	0.805
Math	15	0.339	0.041	0.259	0.419
English	10	0.583	0.110	0.368	0.799
Science	1	0.882	0.304	0.285	1.478
Geography	3	0.382	0.292	-0.189	0.954
Biological	3	0.311	0.084	0.147	0.475

Regarding school level (Table 3), the result of E-Schoolbag' effect for elementary school (0.468) is higher than that for middle school (0.406), and higher then high school (0.312). But from the overall analysis, the E-Schoolbag' effect in various school levels is still small.

Table 3. E-Schoolbag 's Effect Size on Academic Achievement by School Level

School Level	n	Effect size and 95% confidence interval			
		d	SE	Lower limit	Upper limit
Elementary	23	0.468	0.050	0.369	0.567
Middle	11	0.406	0.107	0.196	0.616
High	4	0.312	0.077	0.161	0.464

4. Discussion

According to the results of the overall analysis, the overall, average effect size of E-Schoolbag on students' academic achievement is 0.433. Although the value is a small-to-medium effect size, it still indicates that E-Schoolbag have a positive effect on student learning to some extent. And Compared with traditional paper textbooks, when teacher integrate the E-Schoolbag into the classroom teaching process, it can improve students' learning interest, learning engagement and learning efficiency (Xu et al., 2013). The result also shows that the effect of E-Schoolbag is vary from the subject. It means that when teachers using E-Schoolbag in their classroom, they need to take full account the differences in subjects. Teachers also should be based on specific application needs to make some changes. Rather than take a fixed E-Schoolbag teaching model, teachers should combine with the characteristics of the subject to design their teaching. As for school levels, compared to high school stage, the application of E-Schoolbag in the primary and secondary stage have a better effect. We can explain this phenomenon based on the current state of education. In high school, students' learning relatively fixed, and primary and secondary school learning is relatively free (Zhang, Jiang & Lu, 2016). Therefore, This E-Schoolbag-based ubiquitous learning approach may be more suitable for primary and secondary school students, and students may have more curiosity and interest.

5. Conclusions and Limitations

In this study, we use meta-analysis to survey the effect of E-Schoolbag in Chinese schools, and try to derive an exact value to quantify its effect. The findings indicate that E-Schoolbag contribute to students' academic achievement although they are not as effective as expected. It means that the integration of E-Schoolbag into classroom still a long way to go, and needs to be proved in longer viewpoint. Though government support is very important for the integration of E-Schoolbag in the classroom, schools and teachers should also actively explore the effective way to use E-Schoolbag.
Although This study gives an overall, average effect size of E-Schoolbag on students' academic achievement by using a meta-analysis method, there still have some limitations. The data of Meta-analysis is little, so the results can only explain some of the problems. Future needs to have more research be conducted to compare the effectiveness of E-Schoolbag and the tradition paper textbook.

References

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. 2nd ed. Statistical power analysis for the behavioral sciences. L. Erlbaum Associates.

Xu, X. L., Su, X. B., Wu, Y. H., & Wang, X. H. (2013). Application of Affective Computing in Web-Based Distance Education System: Functions, Current Research and Key Problems. *Modern Distance Education Research* (2), 84-91.

Zhang, W. L., Jiang, Y. J., & Lu, M. X. (2016). A Comparative Study on the Teaching Application of Sino-US E-schoolbag. *Modern Educational Technology*, 26(11), 40-46.

Zhu, Z. T., & Yu, X. H. (2011). E-Schoolbag System and Its Function Modeling. *E-education Research*, 2011(4): 27-34.