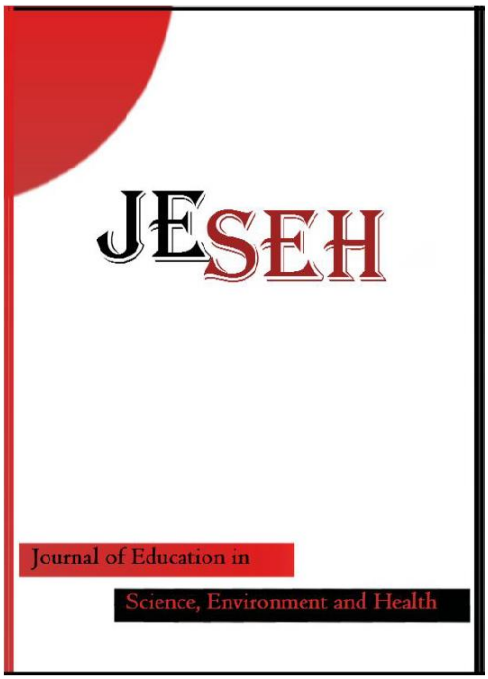

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Integrating E-books into Science Teaching by Preservice Elementary School Teachers

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Abstract

This study aims to discuss the issues of integrating e-books into science teaching by preservice elementary school teachers. The study adopts both qualitative and quantitative research methods. In total, 24 preservice elementary school teachers participated in this study. The main sources of research data included e-books produced by preservice elementary school teachers, a feedback questionnaire on e-book production, and elementary school students' feedback on the use of e-books. The main results of the study are: (1) the preservice elementary school teachers were satisfied with the processes of e-book production; (2) the preservice elementary school teachers demonstrated excellent performance in e-book production; (3) elementary school students were happy to use e-books.

Key words: E-learning, Electronic book, IT education, Science education, Teacher education.

Introduction

In recent years, the booming and rapid development of e-books has had a huge influence on both the information and education industries. An e-book is a new-generation technological product combining several technologies. As early as 1992, van Dam (1992) proposed the phrase "Electronic Book" (also called E-book or eBook for short), which is widely referred to as a medium using electronic channels to store and transport a variety of information and multimedia information-transporting technologies that integrate text, sound, images, videos, and animations.

Since the Amazon online bookstore launched Kindle, Apple Inc. launched the iPad, and Google launched Google books using its own cloud technology, the use of e-books has increased. In recent years, many researchers have conducted studies on the use of e-books for teaching, and they have discovered that e-books could enhance the readers' learning outcomes (Chen, Kao, & Sheu, 2005; Chen, Kao, Sheu, & Chang, 2003; Encheff, 2013; Huang, Huang, and Chen, 2012; Ihmeideh, 2014; Korat, Levin, Atishkin, & Turgeman, 2014; Li, Yang, & Yang, 2013; Liang & Huang, 2014; Liu, Wang, Liang, Chan, Ko, & Yang, 2003; Maynard, 2010; Moody, 2010; Morgan, 2014; Schneider, Kozdras, Wolkenhauer, & Arias, 2014; Schugar, Smith, & Schugar, 2013; Verhallen, Bus, & deJong, 2006; Wang, Lu, and Lee, 2011; Zucker, Moody, & McKenna, 2009).

Studies on e-book production indicate that if we can strengthen training in the production and use of e-books by preservice elementary school teachers' as early as during their preservice teacher training, we may be able to enhance their e-book production and teaching abilities, thus providing multiple experiences and fruitful learning outcomes to their elementary school students. As a consequence, this study aims to discuss the issues of integrating e-books into science teaching by preservice elementary school teachers.

Literature Review

E-books

The changes and development of information technologies have brought infinite possibilities to interactive teaching. E-books have been around for approximately 20 years. Hsieh, Lee, and Cheng (2007) pointed out that e-books are digitally-formed content presented in a multitude of ways, such as texts, images, videos, and

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animations. By using reading devices and corresponding reading software, e-books can replace traditional paper-based reading, and spread information to the public.

Cheng (2009) has further divided the development of e-books in Taiwan into three stages, including: (1) first generation e-books from 1990 to 1998 when PCs and keyboards were used, and the main content was text; (2) second generation e-books from 1999 to 2006 when a mouse was used for PC and PDA operations, and the main content included text, sound and images; and (3) third generation e-books from 2007 to the present when PCs, smart phones, and specialized reading devices are used, finger-touch applications are applied, and the main content includes text, sound, images, videos, and animation.

With respect to the types of e-books, Liao, Tai, and Lin (2010) concluded that common e-books could be divided into three types, including disk e-books, handheld e-books, and computer-system e-books. Kang, Wang, and Lin (2009) pointed out that e-books are portable, have comparatively large screens, and can support learners' studies in different places. Lin and Huang (2010) further explained that the new generation e-books already integrate sound, video, images, and text, and create new features that differ from traditional books.

The advantages of e-books include automatic character searching, and the free readjustment of fonts and font sizes. Page-mode e-books are comfortable to hold, and convenient for making notes and reading. In addition, they eliminate damage problems, such as abrasion and tearing. The cost of an e-book is small and they do not consume environmental resources like trees. They feature rapid and convenient consulting, related information connection, dynamic reading, interactive design, and have other functions, such as electronic bookmarks and annotation tools (Hsieh, Lee, and Cheng, 2007; Lin and Huang, 2010).

However, e-books have several limitations and disadvantages. E-books can only be read with a reading device, and some e-books in special formats can only be displayed after installing special software. For readers, this software may not always be free, and for those who are used to computers, compatibility is not guaranteed (Lin and Huang, 2010).

Hwang, Pan, Liu, and Liu (2012) emphasized that e-books can reduce the need for paper and they consume low levels of energy. Considering the current energy crisis and protection of the environment, it is beneficial for students to use e-books in their studies. In the future, if e-books can replace paper textbooks, it will be of immense benefit to the protection of the Earth.

Many in the fields of industry and academia have conducted discussions and studies on the future development of e-books. In the foreseeable future, e-books may move in two different directions. First, product functions may diversify, i.e. a multi-functional e-book reading device may combine different functions. Based on the display function of electronic paper, future reading devices may also combine touch panel functions, such as handwriting and drawing. Also, considering a phonetic system with human voices, and wireless communication networks, e-books will become similar to current multi-functional portable computers, while their function as an e-book will remain the same or even be improved. They will become smaller, and more convenient to carry. They may have enhanced display technologies, such as flexible screens, low power consumption and be more lightweight. Many value-added functions may also receive more attention. After the success of the touch panel, e-books are one of the applications having the highest potential in the future (Chen, 2009).

To summarize, compared to paper books, e-books have many unique advantages. E-books transform the content of textbooks from a single plane into three dimensions, and integrate multimedia functions, such as video and animation. They provide a richer reading experience, enhance students' motivation and interest in reading, and make learning more lively and interesting.

Teaching and learning with e-books

Pan (2011) pointed out that the success of e-books had spread worldwide. In the future, students will no longer need to carry heavy schoolbags. Instead, they can carry an e-book reader for their studies, which are convenient both to carry and for making notes. A revolution in studies may occur. Dalton (2014b) also pointed out that the digital technologies incorporated into e-books are excellent multimedia tools that could promote the studies of learners.

With respect to the use of and teaching with e-books, Hwang, Pan, Liu, and Liu (2012) have pointed out that a more important advantage of e-books was that they could stimulate new ideas in the learning environment and

in activity design, and enable learning to be conducted outside classrooms and under real learning situations. Knowledge could be used in a lively way and be carried along with the student. Hwang, Pan, Liu, and Liu (2012) further pointed out e-books could assist with learning in classrooms, and also in different places. In recent years, due to the development of reading devices, e-books have become mainstream applications in both classroom learning and outdoor learning and are useful tools for teaching and learning. If good use is made of their advantages, e-books can help with the development of more diversified teaching and richer learning.

With respect to the application of e-books in teaching, Wen, Juang, Lu, and Chen (2010) proposed that when teachers applied innovative technologies in classroom teaching, the core values were: (1) selection and presentation of e-teaching materials rather than the exhibition of sound, light and image effects; (2) enhancement of the interaction between a teacher and students; and (3) encouraging students' initiatives in exploring and thinking. These are the true meanings of blending the information technologies of e-books into teaching practice. Wen, Juang, Lu, and Chen (2010) further explained that the innovations of e-books in recent years were faster and more efficient than what was expected by teachers. Practical utility and teaching efficiency not only attract the attention of students, but also change traditional teaching procedures. As a consequence, teachers can use e-books whenever applicable to their teaching.

From interactive e-books to electronic blackboards, and electronic schoolbags to future classrooms, current information technology tools all emphasize the need to use high-tech situational learning to strengthen students' key abilities. Yang and Liu (2012) have emphasized that the application of information technology tools in teaching should focus on increasing students' willingness to learn and to interact with others, enabling first generation e-learning students to have more opportunities to experience different learning experiences and share in the joy of learning.

However, Ho (2010) also proposed introspection, and emphasized current e-books and cloud education topics had doubtlessly caused revolutionary changes to teaching methods, the forms of teaching materials, and learning methods, which was a challenge that educators, students, and parents could not avoid. Facing technological products that are indispensable to daily life and education, we should not only capitalize on their advantages to benefit teaching methodology, teaching resources, learning behavior, and learning content, but also address the need to avoid the negative influences of these information technology products on the mind and body.

In recent years, many scholars have conducted research on the use of e-books in teaching. The study results show that e-books can promote readers' motivation and engagement (Ciampa, 2012a, 2012c, 2012d; Felvégi & Matthew, 2012; Geist, 2011; Hoseth & McLure, 2012; Jones & Brown, 2011; Maynard, 2010; Nelson, Arthur, Jensen, & Van Horn, 2011; Roskos, Burstein, & Byeong-Keun, 2012; Sloan, 2012; Smith, Moyer, & Schugar, 2011), can improve readers' reading and writing abilities (Ciampa, 2012b; De Jong & Bus, 2004; Ertem, 2010; Gonzalez & Johnson, 2012; Higgins & Hess, 1999; Huang, Liang, & Chiu, 2013; Ihmeideh, 2014; Korat & Shamir, 2012; Korat, Levin, Atishkin, & Turgeman, 2014; Morgan, 2014; Schneider, Kozdras, Wolkenhauer, & Arias, 2014; Schugar, Smith, & Schugar, 2013; Segal-Drori, Korat, Shamir, & Klein, 2010; Shamir & Baruch, 2012), can enhance readers' scientific comprehension (Encheff, 2013; Li, Yang, & Yang, 2013; Wang, Lu, and Lee, 2011; Wen, Juang, Lu, and Chen, 2010), and can increase readers' learning efficiency (Chen, Kao, & Sheu, 2005; Chen, Kao, Sheu, & Chang, 2003; Huang, Huang, & Chen, 2012; Liang & Huang, 2014; Liu, Wang, Liang, Chan, Ko, & Yang, 2003; Moody, 2010; Sun, Flores, & Tanguma, 2012; Verhallen, Bus, & deJong, 2006; Wen, Juang, Lu, & Chen, 2010; Zucker, Moody, & McKenna, 2009).

A study by Wang, Lu, and Lee (2011) has shown that students participating in the study produced mental images that were pleasant, interesting, and enlightening towards the teaching content, teaching material design, and computer interfaces. The study results showed that e-books can be blended into teaching, achieve efficient learning, improve students' attitudes towards science, promote students' reading motivation, and increase students' learning comprehension of science.

A study by Huang, Huang, and Chen (2012) has shown that students' acceptance of e-book learning is affected by gender differences. Girls demonstrate a higher acceptance of e-book learning than boys. However, there are no significant differences in background variables, such as grades, amount of computer use each week, and the monthly frequency of using mobile devices for e-reading. Other studies have also shown similar results. Huang, Liang, and Chiu (2013) have pointed that out although, in stereotyping, boys were considered to be more interested in computers and information technology applications, their study showed girls performed better in e-book reading than boys.

A study by Encheff (2013) has shown that after using e-books for study, students gained a better comprehension of science concepts, and developed more proficient scientific technology application abilities. Meanwhile, students' problem-solving abilities in subject-based learning are cultivated, and their self-efficiency and confidence in learning are enhanced.

Li, Yang, and Yang (2013) used different teaching strategies to discuss the learning outcomes of e-book teaching. The study results showed that the method of teachers explaining the knowledge first, and then using e-books to conduct teaching has the best learning outcome. However, there are no significant differences in variables, such as cognitive load and learning motivation.

To summarize, e-books can inspire reading motivation and interest, and improve readers' learning outcomes. It is worthwhile when promoting e-books to allow students to have more opportunities to encounter different learning experiences, and share the joy of learning. However, when using e-books, proper assistance and guidance should be provided to students to avoid Ho's (2012) concern that information technology products can negatively influence the mind and body.

E-book Production and Preservice Teacher Education

To strengthen and promote e-book learning, the Digital Textbook Collaborative (2012) has also proposed a framework and blueprint for e-book design and application. The Digital Textbook Collaborative (2012) has also further emphasized when designing e-books, with respect to the application of e-books, that designers should pay more attention to the provision of richer, interactive learning experiences and customized learning to students, encourage cooperative learning, and provide learning feedback, plus supportive and formative assessments that help students to study.

Second, with respect to the cultivation of e-book production and design abilities, Liao and Pan (2010) pointed out that people in the digital publishing industry should possess seven abilities, including text editing, graphic design, digital design, video production, digital distribution, digital copyright management, and program design (quoted from Liao, Pan, & Tsai, 2013, p. 65). Liao, Pan, and Tsai (2013) further pointed out that the professional abilities for e-book production and design included (1) software operation and setting, (2) text style setting, (3) picture and text layout, (4) dynamic document setting, and (5) format transformation.

The above-mentioned professional abilities required for e-book production are actually abilities that should be cultivated and taught during the preservice training of elementary school teachers (Dalton, 2014a). When teachers are proficient in the digital technology tools of e-books, self-education can benefit their professional improvement, and will help them to guide their students and promote better learning outcomes.

Dalton (2014a) further pointed out that teachers are designers of learning, and in the 21st century, teachers should acquire the knowledge-ability of producing their own e-books. Dalton (2014a) has recommended using Book Builder (a free software package developed by the non-profit organization CAST, website: www.cast.org) as the tool for compiling e-books, as Book Builder could integrate texts, sounds, images, and videos, and is easy to operate.

At the same time, Li and Huang (2012) pointed out that as technology and e-book reading devices advanced day by day, the content of the e-books should also be enhanced to meet the requirements of learners. Huang (2013) further explained that due to the Internet and the digital convergence technology of the media, traditional media forms, such as the presentation method of a book, video, and sound, enable us to create diversified designs and innovations. Taking interactive e-books as an example, in terms of creation, creators can apply the features of multimedia into the text content. Instead of a single presentation method for the original media, creators can now blend in additional multimedia features. In terms of production, producers should make better use of the features of multimedia, use systematic planning, and combine the multimedia elements of animations, images, and videos to assist creators to realize their creative ideas. In terms of browsing, producers should also design a good reading environment and interfaces so any interest in reading and appreciation will not be harmed due to operational problems.

To summarize, in today's knowledge-based economy, e-books topics show e-books offer great educational functions and value. If the use and promotion of e-books can be strengthened, it is believed that greater educational outcomes will be brought to elementary school classrooms. As a consequence, how to strengthen training in the professional abilities of e-book production for preservice elementary school teachers is an

initiative worth promoting and implementing. E-books designed by preservice teachers can be used as study materials by elementary school students. E-books can also help elementary school students to enhance their reading literacy, develop lifelong reading habits, improve their learning outcomes, and promote the goals of information literacy.

Research Methods

This study adopted both qualitative and quantitative research methods. The participants were 24 preservice elementary school teachers. The participants first received a three-week training course on e-book production. Referring to strategies proposed by the Digital Textbook Collaborative (2012), the training emphasizes how the design content of an e-book should aim to provide a rich interactive learning experience and customized learning for students, encourage cooperative learning, and provide learning feedback as well as supportive and formative assessments. The software used for e-book production in this study was the free package software ShineCue 2.0.0.27 (this software was developed by Chiayi Educational Network Center, and the center authorizes teachers and students from contract standard schools to use the website which can be found on ebook.cy.edu.tw). Following on from the training course, the preservice elementary school teachers then conducted a six-week e-book production session. Each teacher finally completed one e-book. Consequently, a total of 24 e-books were produced.

Second, considering the requirements of subsequent e-book promotion and teaching, with respect to the subject content of e-books, the preservice elementary school teachers were asked to use minerals and rocks as their theme. The future users of the e-books were deemed to be Grade 5 and 6 students.

After the preservice teachers produced their e-books, the e-books were used in an elementary school. In this way, the study assessed the feasibility and practical utility of the e-books produced, and used them as indices to assess the e-book production outcomes of these preservice teachers. The users of these e-books were Grade 6 students from an elementary school in New Taipei City. A total of 48 students from two classes used the e-books. The reading devices used were tablet PCs assigned to the school by the municipal government of New Taipei City. The use and teaching processes were as follows. Each student freely selected an e-book from the 24 e-books on offer. From the second week, study groups of two or three students were formed to conduct learning and discussions. In the final week, each group selected one e-book to complete an e-book reading and comprehension sheet. The content of the e-book reading and comprehension sheet included (1) drawing the content of the e-book in the form of a reading mind map (each group drew one mind map), (2) scoring the likeability levels of the e-books (the full score was 10, and each member of the group had to give a mark), and (3) obtaining feedback and suggestions on learning.

The data of this study were mainly collected from e-books produced by the preservice elementary school teachers, feedback questionnaire on e-book production using a Likert five-point scale. The Cronbach's α reliability was 0.77. The feedback and suggestions on e-book use by the elementary school students were obtained using an e-book reading and comprehension sheet, including the drawing of reading mind maps, scoring the likeability levels of e-books, and an open-ended question. The validity of the research tools was examined by three content experts, and the research tools were confirmed to have good validity.

Results and Discussion

Feedback on e-book Production by Preservice Elementary School Teachers

After the preservice teachers had completed an e-book production, this study conducted a survey using a Feedback Questionnaire on E-book Production consisting of a 5-point Likert-type scale. A total of 24 preservice elementary school teachers returned a valid feedback questionnaire. The backgrounds of these teachers are shown in Table 1. The Distribution Summary of the Measurement Results of the Feedback Questionnaire on E-book Production are shown in Table 2.

Table 1. Background of the Preservice Elementary School Teachers

Gender	Number	Percentage (%)
Male	12	50.0
Female	12	50.0

According to Table 2, the results from the Feedback Questionnaire on E-book Production are as follows: (1) 37.5% of the preservice teachers indicated they were suited to producing e-books while 33.3% of the teachers indicated that they disagreed or strongly disagreed. The remaining 29.2% of the teachers indicated undecided. (2) 33.3% of the preservice teachers indicated the e-book compilation software was easy to operate while 37.5% of the teachers indicated that they disagreed or strongly disagreed. The remaining 29.2% of teachers indicated undecided. (3) 20.8% of the preservice teachers indicated the functions of the e-book compilation software were sufficient for use while 54.2% of the teachers indicated that they disagreed or strongly disagreed, with the remaining 25.0% of teachers indicating undecided. (4) 58.3% of the preservice teachers indicated that e-books are charming while 25.0% of the teachers indicated that they disagreed or strongly disagreed, with the remaining 16.7% of teachers indicating undecided. (5) 75.0% of the preservice teachers indicated that e-books can help increase students' comprehension of science content while only 8.3% of the teachers indicated that they disagreed or strongly disagreed. The remaining 16.7% of teachers indicated undecided. (6) 62.5% of the preservice teachers indicated that e-books can help students conduct science experiment exploration while 20.8% of teachers indicated that they disagreed or strongly disagreed, with 16.7% of the teachers indicating undecided. (7) 54.1% of the preservice teachers indicated that e-books can help with their science teaching while 16.7% of the teachers indicated that they disagreed or strongly disagreed, with the remaining 29.2% of teachers indicating undecided. (8) 45.8% of the preservice teachers indicated that after using e-books, they were willing to use them in their science teaching while 20.8% of the teachers indicated that they disagreed or strongly disagreed, with the remaining 33.3% of teachers indicating undecided. (9) Overall, 41.7% of the preservice elementary school teachers indicated that they liked producing and using e-books, while 20.8% of the teachers indicated that they disagreed or strongly disagreed. The remaining 37.5% of teachers indicated undecided.

Table 2. Summary of the Measurement Results of the Feedback Questionnaire on E-book Production (N=24)

Item	Strongly Agree		Agree		Undecided		Disagree		Strongly Disagree	
	N	%	N	%	N	%	N	%	N	%
1	2	8.3	7	29.2	7	29.2	6	25.0	2	8.3
2	0	0	8	33.3	7	29.2	7	29.2	2	8.3
3	0	0	5	20.8	6	25.0	10	41.7	3	12.5
4	3	12.5	11	45.8	4	16.7	5	20.8	1	4.2
5	2	8.3	16	66.7	4	16.7	2	8.3	0	0
6	1	4.2	14	58.3	4	16.7	5	20.8	0	0
7	2	8.3	11	45.8	7	29.2	3	12.5	1	4.2
8	2	8.3	9	37.5	8	33.3	5	20.8	0	0
9	0	0	10	41.7	9	37.5	4	16.7	1	4.2

The study results showed that the usage satisfaction of the preservice elementary school teachers with the e-book compilation software ShineCue was of low to medium-level. It is considered that the reason could be that ShineCue being free software rather than business software, the functions and interfaces of the operational system may not have been smooth, exquisite, and user-friendly enough. As a result, the user satisfaction with ShineCue remained at the low to medium-levels. The study did not adopt the software Book Builder recommended by Dalton (2014a) because it is written in English, which was not appropriate for the use of preservice elementary school teachers and elementary school students in Taiwan for whom the medium of instruction is Mandarin.

On the other hand, the preservice elementary school teachers highly praised the qualities and educational functions of e-books (75.0% of the teachers believed that e-books can increase students' comprehension of science content, and 62.5% of the teachers believed that e-books can help students carry out science experiment exploration), indicating the teachers agreed that e-books can help students with their learning and teachers with their teaching. Finally, overall, 41.7% of the preservice elementary school teachers indicated that they liked producing and using e-books, while 20.8% of the teachers indicated that they disagreed or strongly disagreed, with the remaining 37.5% of teachers indicating undecided. This means that a large proportion of the teachers approved of the production and use of e-books. However, if the functions and interfaces of the e-book compilation software could be greatly improved, it is believed that more preservice teachers would approve of and also use it.

Assessment of e-books

Preservice elementary school teachers who participated in this study produced one piece of work after each conducting a course on e-book compilation and production. The 24 preservice teachers produced 24 e-books in total. The assessors then conducted an assessment of the e-books from the perspective of content quality, scientific correctness, and design originality.

The assessment results showed that in terms of the content of the e-books produced by the preservice teachers, all the 24 e-books fully displayed the special effects of an e-book. Together, the text presentation, pictures and images, colors and picture composition, sounds, videos, and animations fully presented the exquisite multimedia effects of the e-books. Some of the works even made good use of sound and video to compile splendid dynamic images, and present exquisite reading qualities, and the overall appearance of these works was rather exquisite and delicate. Second, in terms of performance with regard to science content, the content of all the e-books clearly explained the correct scientific characteristics of minerals and rocks, the features of their appearance, and the aesthetic presentation of minerals and rock samples to attract the readers' attention and enable them to recognize minerals and rocks correctly. In terms of the performance of design originality, many works combined the multimedia elements of pictures, sounds, videos, and animations very well to produce scientific images and rich artistic connotations, and to give full considerations to the features and advantages of e-books. This result confirms the opinions on e-books presented by Ho (2012), Hsieh, Lee, and Cheng (2007), Hwang, Pan, Liu, and Liu (2012), and Lin and Huang (2010). In addition, one of the works entered an e-book design competition held by Tang Digital Integration, and was successful in achieving a Finalist Award.

Feedback on the Use of e-books by Elementary School Students

After the preservice teachers completed their e-book production, the e-books were used by elementary school students in an elementary school. The students were subsequently required to conduct an assessment of these e-books. A total of 48 students from Grade 6 used the e-books. The 48 students (divided into 18 groups) completed the reading and comprehension sheets of 18 e-books. The contents of the e-books and the comprehension sheets included (1) drawing a reading mind map, (2) scoring the likeability levels of the e-books (full score of 10), and (3) providing feedback and suggestions on learning.

After the elementary school students completed their e-book reading and comprehension sheets, the 18 comprehension sheets were analyzed. According to the contents of the reading mind maps drawn by each group, all participating students were found to be inspired by e-book reading, and all groups could effectively transform the content of the e-books into mind maps, presenting the themed science concepts of the e-books very well. The study results showed that elementary school students can ascertain the corresponding science concepts through e-book reading, and the content of e-books can actually enhance elementary school students' comprehension of science.

Second, the results of the e-book likeability scoring showed that the average score for the 48 elementary school students was 8.46 (the full score was 10), with a standard deviation of 1.69. The study results indicated that the elementary school students enjoyed the e-book reading activity, indicating that the contents of the e-books were relevant to their science studies.

As a consequence, on the whole, the e-books produced by the preservice elementary school teachers were well received by the elementary school students, and the contents of the e-books were able to improve the learning outcomes of the elementary school students, indicating that the production and performance of the e-books achieved the intended educational goals.

Conclusion

In recent years, due to the rapid development of e-book reading devices, e-books have started a revolution in learning. In view of the importance of e-books, this study conducted e-book production and training into science teaching by preservice elementary school teachers. The study results showed that although the satisfaction of the e-book compilation software ShineCue by the preservice teachers was only of a low and medium-level, the teachers had a high opinion of the qualities and teaching functions of e-books, generally believing that e-books can help both students and teachers with their learning and teaching, respectively. Second, e-books produced by the preservice teachers were exquisite and delicate, and clearly explained the

scientific characteristics of minerals and rocks, demonstrating the features of multimedia, and fully manifesting scientific images and rich artistic connotations. In addition, the feedback on e-book use by elementary school students showed that these e-books were actually well received by elementary school students as the contents of the e-books improved their science learning outcomes. As a consequence, the production and performance of the e-books by preservice elementary school teachers attained considerable educational achievements.

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