

# A pilot test on the application of an e-book with videos in the teaching and learning of compounding for pharmacy students

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## Abstract

The e-book phenomenon has taken us to a whole new era in knowledge dissemination. Although printed books still have their place in the heart of many, the application of e-books may compliment the current role of printed books, besides serving as a low-cost option with less physical storage space needed. Printed books have always been a source of reference for students. However, this is not always practical especially in the laboratory settings where students' rapid movements may cause liquid spillage and unwanted accidents on the printed books. Hence, e-books may become a handy option with more easily updated information. Pharmacy, as with other professional courses, requires graduates to develop specific knowledge and skills such as the skill of medication compounding. This reported pilot study was conducted on the application of a practical guide e-book for compounding in pharmacy, which provided guidance to students on laboratory ethics, product documentation, prescription interpretation and pre-formulation calculation, with incorporated product preparation videos for easy and fast referencing. Students were able to refer to the videos in the e-book during practical classes to learn and avoid any mistakes during product preparations. The results showed that 39% of students agreed on the application of the e-book in practical classes, but 59% of them preferred the e-book for revision purposes. The e-book should complement and not totally replace the printed laboratory books, and would be useful to enhance students' experience in laboratory teaching and practical classes. The presentation and the content of the e-book needs further refinement to ease its use and application.

**Keywords:** *E-book, Compounding, Video, Pharmacy, Practical class*

## Background

### *E-books in education*

The application of e-books began nearly 50 years ago, when Michael Hart in 1971 started to use computers to store and retrieve information, paving the way for the development of electronic versions of printed books - known as e-books. The definition of e-books, however, varies according to the nature and the extent of the versions (Embong *et al.*, 2012). Armstrong *et al.* (2002) developed the most commonly used definition:

*“...the term e-book to mean: any piece of electronic text regardless of size or composition (a digital object) but excluding journal publications, made available electronically (or optically) for any device (handheld or desk-bound) that includes a screen.”*

The e-book phenomenon has taken us to a whole new era in knowledge dissemination. Although printed books still have their place, the application of e-books may compliment the current role of printed books, besides serving as a lower-cost option needing less physical

storage space (Woody *et al.*, 2010). Perhaps because they are much cheaper than the printed versions, the sales of e-books are skyrocketing, as described by the American Association of Publishers (AAP). According to them, the sales of e-books have increased tremendously over the years, generating slightly below US\$1 billion in 2018 (AAP StatShot, 2019). Many advantages may be attributed to e-books, and readers are directed to other publications which describe the comparison between printed books and e-books, and the advantages and disadvantages in detail (Ebied & Rahman, 2015; Nie *et al.*, 2017).

In tertiary education, the application of e-books is usually restricted to classroom and personal reading (Ongoz & Baki, 2010). Nie *et al.* (2017) reported on the use of e-books for distance learners and showed that their learning experience is enhanced with the magnitude of different materials available in e-books. The students also agreed that e-books increase their flexibility and enabled learning on the move, which is very important to them as working students. In addition, the different types (or

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formats) of contents that could be incorporated in an e-book could help teachers and lecturers to diversify their teaching approach and hence improve the outcome of teaching and learning (Rajadell & Garriga-Garzon, 2017). The engaging and attractive features in e-books could encourage students' creativity and learning autonomy besides allowing teachers and lecturers to enhance their teaching methods (Embong *et al.*, 2012).

With the advancement of technology, many devices are now available that could facilitate students' learning activities. Devices such as smartphones, laptops and tablets are made affordable for students and could be owned by many. Based on the data reported by the ECAR Study of the Undergraduate Students and Information Technology, across 15 countries, 86% of undergraduate students owned a smartphone in 2014. This number would have increased significantly since then. This means that the majority of students could benefit from electronic-based resources such as e-books. In addition, e-reader applications (apps) and devices such as Amazon Kindle have been developed enabling easy access to e-books with certain beneficial functions such as highlighting, note-taking and annotation (Nie *et al.*, 2017).

Compounding is a knowledge discipline that is taught formally and uniquely to pharmacy students (Eley & Birnie, 2006). It requires sufficient understanding and good technique to produce each pharmaceutical product (Chowdhury, Taylor & Harding, 2003). To understand compounding, students need to understand both the theory (from lectures) and the practical aspects that would be experienced during practical classes.

The experiences from these double learning activities help them to build a strong foundation and enable the students to acquire the skills needed in this subject area (Scoville, 1912; Choo *et al.*, 2018). This strong foundation could be further reinforced with the application of e-books, in which the presence of compounding videos help them to visualise the theoretical knowledge obtained during the lectures and to apply the knowledge correctly with manual dexterity during practical classes (Scoville, 1912). In addition, the e-book also helps with revision and facilitates the retention of information post-graduation, since the students have lifelong access to the materials present in the e-book, which may become handy in later years as they become practicing pharmacists.

A study at Duke University in 2004 found that students in several subject areas, which included medicine, computers and psychology, easily accepted and used e-books for study purposes (Millar & Schrier, 2015). Hence, it is not surprising to find many e-textbooks available online for pharmacy education. A search on the internet showed that the available e-textbooks include topics in chemistry, physiology, drug materials analysis and clinical pharmacy practice, among others.

For topics under pharmaceutical compounding, many compounding reference books available currently are

those of printed version such as the pharmacopeia (United States Pharmacopeia, British Pharmacopeia and others) and a number of reference books available in e-book format. These books are expensive, based on website observations conducted online for Amazon and ebook.com. Highly priced books means that not all students will be able to own the needed reference books (Stein *et al.*, 2017). In practical classes however, a quick reference is crucial and needs to be concise and up-to-date. Due to this factor, e-books may be an option for students, especially for practical classes which should have up-to-date information at a very low cost, stored on a mobile device and easily accessible (Nie *et al.*, 2017).

Realising this need, the authors prepared an institution-based e-book entitled 'Course Guide for Non-Sterile Compounding Practice' for pharmacy students at Universiti Sains Malaysia. The e-book was prepared mainly as a guide for laboratory-based practical classes for compounding, with the information gathered from reliable resources and credible reference books, together with further explanations, calculation exercises and product compounding videos prepared by the authors. This e-book could be a useful option to the digital native today and since it was made simple and suitable for smartphone viewing, it could serve as an affordable source of reference to students.

In this paper, the authors describe a pilot study conducted to assess students' acceptance of the e-book produced. The students were given the chance to access and use the e-book, and their responses were recorded through a questionnaire. The results were reported, analysed and described in the following sections.

## Method

The authors produced the 'Course Guide for Non-Sterile Compounding Practice' originally in printed form. The printed book (40 pages) was distributed to the students at a minimal cost.

The book was then converted into e-book format with the aim of serving as a reference on the go, especially during practical classes. The content of the e-book was based on the course outline, the basic knowledge of first year students, and based on the previously used print version. In doing so, the content of the book was improved with the presence of product-compounding videos as a quick guide during practical classes. As was mentioned earlier, compounding needs specific techniques for each product and the presence of these videos should be a benefit to the students.

The e-book produced was in HTML format with linked videos. The e-book was available online for the students to access at all times, during teaching, laboratory sessions and revisions, in the university or at home. Because this was a pilot project, the e-book was distributed to the first year students for free (124 students). Table I lists the chapters present in the e-book.

**Table I: The e-book chapters in ‘Course Guide for Non-Sterile Compounding Practice’**

CHAPTER	CONTENT
Chapter 1	General noted on compounding in pharmacy
Chapter 2	Common medical terms in pharmaceutics
Chapter 3	Latin abbreviations
Chapter 4	General units in pharmacy
Chapter 5	Types of pharmaceutical preparations, storage, packaging and labelling requirements
Chapter 6	Prescriptions and preparation of formulations
Chapter 7	Paediatric doses, weighing and measurements
Chapter 8	Non-sterile dosage forms
Chapter 9	Pharmaceutical calculation exercises
Chapter 10	Compounding videos

**Results**

The e-book was assessed by current first year students (124 students: male (31), female (93); 19-20 years old). An online questionnaire was developed to assess the students’ preferences and experience on using the e-book. Responses were obtained from 107 students (26 male, 81 female) based on Raosoft sample size calculator, n=94 would be sufficient to obtain 95% confidence intervals. The questions that were included in the survey are available in Appendix A.

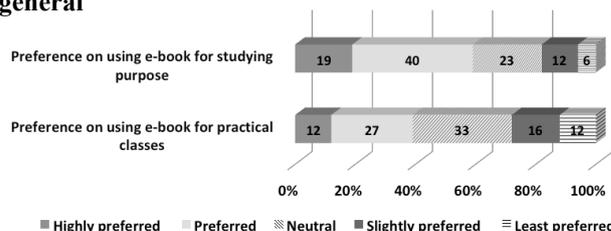
From the survey conducted, 62% of students said that laptops were their number one tool in studying whilst another 36% said smartphones were their main device. No students owned an e-reader. Only slightly more than half of the respondents (55%) believed that an e-book was suitable for them (Table II).

**Table II: Students’ perception towards e-books in general**

	Yes	No	Maybe
Do you think e-books are suitable for you?	55% (59)	11% (12)	33% (36)
Will the price of a book influence your buying habit?	65% (69)	9% (10)	26% (28)
Would you buy an e-book rather than the printed book if the e-book was sold at half the price of the printed version?	21% (22)	36% (39)	43% (46)

Sixty-five percent of the respondents said that the price of books was an important factor that determined their buying habit, but only 21% preferred to buy e-books rather than printed books. Figure 1 depicts students’ preferences in using e-books either for revision or during laboratory practice. As can be seen, the number of respondents that prefer e-books for practical classes was much lower (39%) than those who would use the e-book for revision purposes (59%).

**Figure 1: Students’ responses regarding e-books in general**



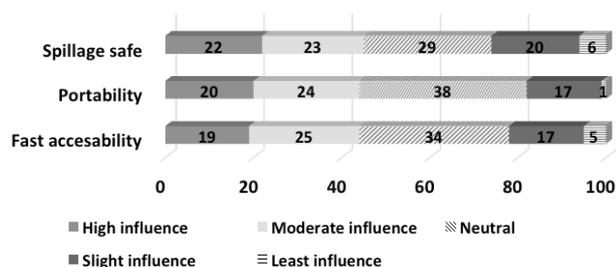
As the main objective of producing this e-book was for laboratory sessions, the students were asked on their opinion regarding the usability of the e-book. Table III below summarised the results obtained:

**Table III: Students’ perception towards use of e-book in practical sessions**

	Yes	No	Neutral
Do you think the layout of the e-book is practical?	57% (61)	4% (4)	39% (42)
Do you think this e-book is a good alternative for its printed version to be used in practical classes?	41% (44)	17% (18)	42% (45)
Would you prefer to use this e-book during practical classes as compared to the printed version?	31% (33)	40% (43)	29% (31)

Slightly more than half of the students agreed that the layout of the e-book was practical and only 4% described otherwise. In terms of the usability of the e-book, 42% of the students agreed that the e-book was a good alternative to the printed version for practical classes, but only 30% of them preferred to use the e-book as compared to the printed book. This would mean that if they were given a choice, many would still prefer the printed books compared to the e-book in laboratory settings. Figure 2 below described the factors that influenced the students in choosing to use the e-book in a practical class.

**Figure 2: The factors that influence students' acceptance towards the application of e-book in practical classes**



Forty-five percent of students agreed that the potential for spills spoiling printed books was an important issue. In term of portability and fast accessibility, less than half of the students felt that these factors would influence their acceptance towards the use of the e-book in laboratory sessions.

Concerning the product-compounding videos incorporated in the e-book, the students agreed that the videos were beneficial and as presented in Table IV, 74 % of respondents confirmed that they referred to the compounding videos during practical sessions.

**Table IV: Students' response regarding product-compounding videos**

	Yes	No
Does the presence of the product-compounding videos in the e-book help you in your practical classes?	75% (80)	25% (27)
Do you refer to the product compounding videos during practical classes?	74% (78)	26% (29)

The overall comments from the students were positive, with some suggestions on the technicality such as font size and layout of the e-book.

*"The e-book is very interesting and makes it faster to access information needed because they can just search for the keywords in the search bar"*

*"I think this e-book is a good way to improve accessibility of student to the notes..."*

In terms of overall application, 63% of the students agreed on the ease of accessibility of the e-book during revision, while some expressed their worry that the internet connection problem may hinder their access to the e-book.

## Discussion

Only 55% of the respondents felt that e-books were suitable for them. A similar result was found by Embong *et al.* (2012), who reported that some students do not favour e-books because they do not offer the same pleasure as conventional books. This could depend on the type of the e-books and use, either for serious studying purposes or for quick reference. E-books may be an option for quick reference purposes, but for serious studying, many students would still choose printed books (Lam *et al.*, 2009; Embong *et al.*, 2012).

Among the important factors that determine students' preference to use an e-book is the layout. As described by Malama *et al.* (2004), layout, ease of navigation and logical structure are parts of the motivational factor for students to use e-books. Layout is even more important in e-books meant for quick reference since the ease of navigation will help students to locate the needed information quickly and accurately.

In many studies, printed books seem to be more popular than e-books among undergraduate students, despite the advantage of interactivity commonly associated with e-books (Lam *et al.*, 2009; Woody *et al.*, 2010). Shepperd and co-workers reported that 90% of students in their study would not buy an e-book over a printed textbook, despite being cheaper and easily accessible (Shepperd *et al.*, 2008). One study reported on complaints by students about reading long text on e-books as tiring, less efficient and 'painful' (Wilson, 2003; Woody *et al.*, 2010). This could be the reason for the students' favouring printed books for serious reading and studying.

The results of this study suggested that for this group of respondents, the e-book was more applicable for revision. This could be due to not being accustomed to using e-books or the inconsistency of internet connection in the laboratory, influencing their refusal to choose the e-book as their main reference in the laboratory. Students in the current study indicated that they would choose the most convenient mode of reference, which will give the information that they need when they need it. Although the e-book offers interactivity and is visually attractive, students did not show major preference towards the e-book as compared to the printed book. This could be explained by a study reported by Morris and Lambe (2017) in which they studied the use of an interactive multimedia e-book in bioscience laboratory classes. The authors said that students have a tendency to choose the traditional printed books if the interactivity of an e-book could not offer any added advantage. This seems to be the similar reaction by the students in this study.

The concern about internet connection is no longer a problem with the installation of Wi-Fi routers throughout the faculty, which will increase the students' accessibility to the e-book. Being accustomed to using a technology on the other hand may have some impact on a student's choice. In order for a technology to be well-accepted, it needs to be adapted well into one's life. This could be the

case for these students and was also described by Shepperd *et al.* (2008) in which they believed that the application of electronic texts and e-books might require a learning curve. The popularity of this medium may increase once the students become more familiar and comfortable with the e-book.

The videos are among the important parts of the e-book and the benefit of the e-book could be attributed mainly to the videos. The presence of videos and moving graphics in e-books is useful to illustrate the hard-to-visualise activities that is sometimes the case in compounding classes (Brame, 2016). Videos was reported as one of the factors that increases the visual appeal in an e-book, which will interest the students (Woody *et al.*, 2010). Figueiredo and co-workers have also produced an e-book with embedded videos for teaching of mathematics to students at secondary school level. They agrees that videos are a useful medium to attract students' attention (Figueiredo *et al.*, 2016). In addition, the incorporation of videos in e-books could also help in the reinforcement of memory. Visual aids have been shown to have a significant impact on students' memory and this could help in ensuring the retention of information by students (Ljubojevic *et al.*, 2014; Brame, 2016).

## Conclusion

Based on the data and discussion presented in this paper, it can be concluded that the application of an e-book in laboratory setting should complement and not totally replace the printed laboratory books. E-books would be a useful method in enhancing students' experience in laboratory teaching and practical exercises. Taking the students' opinions and comments into consideration, the authors will continue to work on improving the e-book besides promoting the optimal use of the e-book to the students. There is a wide potential for e-book application in laboratory settings. An effective formula needs to be discovered and that may help to further improve the efficiency of laboratory sessions besides providing the students with the best learning experience. The availability of good internet access is critical to the successful implementation of e-books.

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## Appendix A

### The Questionnaire

1. What device(s) do you have that can be used to support your study?
2. Will the price of a book influence your buying habit?
3. Do you think e-books are suitable for you?
4. Please rank your preference on using e-books for studying/revision purposes.
5. Please rank your preference on using e-books for practical classes.
6. Do you think the layout of the e-book is practical?
7. Do you think this e-book is a good alternative for its printed version to be used in practical classes?
8. Would you prefer to use this e-book during practical classes as compared to the printed version?
9. Does the presence of the product-compounding videos in the e-book help you in your practical classes?
10. Do you refer to the product compounding videos during practical classes?
11. In your opinion, what is the risk probability of liquid spillage on your printed version of Course Guide for Compounding book during practical sessions?
12. For the purpose of revision, would this e-book offers a good option due to ease of accessibility?
13. If the e-book is available at half the price of the printed version, would you buy the e-book rather than the printed book?