



## e-Book Development on Chemical Equilibrium Material for Online Learning during Covid-19 Pandemic

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**Abstract: e-Book Development on Chemical Equilibrium Material for Online Learning during Covid-19 Pandemic.** Education in Indonesia has changed from offline learning to online learning because of the corona virus. The corona virus has been endemic in Indonesia since early March 2020. The COVID-19 pandemic has changed various aspects of human life, including in the field of education. This condition causes all elements of education to utilize ICT for use in the learning process. One of the uses of ICT can be applied to the development of learning resources. The learning process during the pandemic requires learning resources that are interesting, fun, and in accordance with the applicable curriculum. This research is a type of development research that aims to describe the validity, teacher responses, and student responses to e-books on chemical equilibrium material for online learning during the covid-19 pandemic. The research method used is the Research and Development (R&D) method. E-book developed using book creator application. Based on the results of expert validation of the developed e-book, an average percentage of 76.29% was obtained with high criteria in the aspect of content suitability. In the construction aspect of 82.95%, readability of 82.22%, and attractiveness of 83.8%, all three have very high criteria. The results of the teacher's response to the suitability aspect of the material content are 86.67%, readability is 85.6%, and attractiveness is 86.8%, all three have very high criteria. The results of students' responses to the readability aspect were 84.5% and attractiveness was 83.9%, both of which had very high criteria. From the research results it can be stated that the e-book developed is valid.

**Keywords :** e-Book, chemical equilibrium, book creator, covid-19 pandemic.

**Abstrak: Pengembangan e-Book pada Materi Keseimbangan Kimia untuk Pembelajaran Daring saat Pandemi Covid-19.** Pendidikan di Indonesia mengalami perubahan dari pembelajaran luring menjadi pembelajaran daring karena adanya virus corona. Virus corona mewabah di Indonesia sejak awal maret tahun 2020. Pandemi covid-19 telah mengubah berbagai aspek kehidupan manusia, termasuk dalam bidang pendidikan. Kondisi ini menyebabkan seluruh elemen pendidikan memanfaatkan TIK untuk digunakan dalam proses pembelajaran. Salah satu pemanfaatan TIK dapat diterapkan pada pengembangan sumber belajar. Proses pembelajaran pada masa pandemi membutuhkan sumber belajar yang menarik, menyenangkan, dan sesuai dengan kurikulum yang berlaku. Penelitian ini merupakan jenis penelitian pengembangan yang bertujuan untuk mendeskripsikan validitas, tanggapan guru, dan tanggapan siswa terhadap e-book pada materi keseimbangan kimia untuk pembelajaran daring saat pandemi covid-19. Metode penelitian yang digunakan adalah metode Research and Development (R&D). e-Book

yang dikembangkan menggunakan aplikasi book creator. Berdasarkan hasil validasi ahli terhadap e-book yang dikembangkan, diperoleh rata-rata persentase sebesar 76,29% kriteria tinggi pada aspek kesesuaian isi. Pada aspek konstruksi sebesar 82,95%, keterbacaan sebesar 82,22%, dan kemenarikan sebesar 83,8%, ketiganya memiliki kriteria sangat tinggi. Hasil tanggapan guru terhadap aspek kesesuaian isi materi sebesar 86,67%, keterbacaan sebesar 85,6%, dan kemenarikan sebesar 86,8%, ketiganya memiliki kriteria sangat tinggi. Hasil tanggapan siswa terhadap aspek keterbacaan sebesar 84,5% dan kemenarikan sebesar 83,9%, keduanya memiliki kriteria sangat tinggi. Dari hasil penelitian dapat dinyatakan bahwa e-book yang dikembangkan valid.

**Kata Kunci:** e-Book, kesetimbangan kimia, book creator, pandemi covid-19.

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## ▪ INTRODUCTION

Education in Indonesia is currently undergoing a change from offline learning to online learning due to the corona virus or known as COVID-19 (*Corona Virus Disease-2019*). The corona virus has been endemic in Indonesia since March 2, 2020 as many as 2 cases (WHO, 2020). The Government of the Republic of Indonesia reported that there were 2,178,272 confirmed positive cases as of June 30, 2021 and there were 58,491 patients who died and 1,880,413 recovered patients spread across 34 provinces and 415 districts/cities (Ministry of Health, 2021). The COVID-19 pandemic has changed various aspects of human life, including in the field of education.

To break the spread of COVID-19, namely by implementing restrictions on community interaction or commonly referred to as *physical distancing* (Mustakim, 2020). According to Kusuma and Hamidah (2020) the problems during the pandemic are time, location and distance. Therefore, online learning (on a network) is a solution to overcome difficulties in carrying out the learning process (Herliandry et al, 2020). Conditions that cause all elements of education utilizing information and communication technology (ICT) for use in the learning process. This is supported by Ahmed and Hassanien (2020) who state that innovation and adaptation related to the use of available technology to support the learning process must be carried out. One of the uses of ICT can be applied to the development of learning resources.

Along with the development of technology, ICT-based learning resources that can be developed in the form of digital books or better known as *e-books*, which are electronic versions of books (Haris, 2011). Suarez & Wooudhusyen (2013) said that an *e-book* is a textbook in digital form and consists of images, text, animation in it that can be read on a laptop or electronic device. According to research conducted by Solihah (2020) by using e-books students will find it easier to do online learning according to teacher directions, students just access the internet and use e-books as directed by the teacher.

Based on a preliminary study of three teachers from three SMA/MA in Bandar Lampung, namely SMAN 10, SMAN 15, and MAN 2, it can be seen that 100% of teacher respondents have difficulty teaching chemical equilibrium material during online learning. During online learning 100% of the teacher respondents use printed books as teaching materials. As many as 66.7% of teachers use *e-books*. Only 33.3% of teachers have ever developed an *e-book*. All teachers who were respondents stated that it was necessary to develop an interactive *e-book* on chemical equilibrium material for online learning during the covid-19 pandemic to make it easier for students to learn chemical equilibrium material.

Based on the results of filling out student questionnaires, totaling 60 respondents from 3 SMA/MA Negeri in Bandar Lampung, it is known that as many as 73.3% of student respondents use printed books during online learning to study chemical equilibrium material. As many as 65% of student respondents use *e-books* to study chemical equilibrium material, but the *e-books* used are still dominated by material explanations and chemical equilibrium learning videos given by the teacher separately using *links* not included in the *e-book*. Furthermore, 61.7% of student respondents said there needed to be improvements in the learning resources used to study chemical equilibrium material. As many as 85% of student respondents said it was necessary to develop an *e-book* for online learning during the covid-19 pandemic

Previous research conducted by Suprpto (2019) who developed an animation-based interactive *e-book* concluded that *e-books* are very effective for student learning completeness. Another study conducted by Wulandari, Abidin, & Praherdhiono (2020) who developed an infographic *e-book* reported that *e-books* were effectively used for independent learning. Then, Putrawansyah (2016) who developed an *Android*-based digital book on heat transfer material in senior high schools obtained the results that the use of digital books was effective on student learning outcomes.

Based on this, "E-book Development on Chemical Equilibrium Material for Online Learning during COVID-19 Pandemic". Learning using *e-books* can be done anywhere and anytime so that it can make it easier for students to learn.

## ▪ **METHOD**

### **Research design**

Research design that used in the development of e-book on the chemical equilibrium material for online learning during covid-19 pandemic is Research and Development (R & D). According to Borg and Gall (1989), there are ten steps used in the implementation of Research & Development. These steps, namely (1) research and information gathering, (2) planning, (3) product development, (4) initial field trials, (5) revision of test results, (6) field trials, (7) revision of the results of field trials, (8) field testing, (9) revision of the final product, (10) dissemination and distribution. In this study, it was only carried out up to stage 5, namely the revision stage of the trial results. This is due to the limited time of the researcher to proceed to the next stage.

### **Research Data Sources**

Sources of data in this study came from students and teachers. In the preliminary study, the data sources were obtained from three chemistry teachers and 60 students of class XI MIPA from three public high schools in Bandar Lampung. The data is in the form of a needs analysis questionnaire given to teachers and students online in the form of google forms. Then in the initial field trial stage, the data sources were obtained from five chemistry teachers and 63 students of class XI MIPA selected from three high schools in Bandar Lampung.

### Data collection technique

Data collection in this study was carried out online using google forms. The instrument used in this study are (1) the instrument on a preliminary study in the form of instruments needs analysis and provided to teachers and students, (2) instrument expert validation aspects of the suitability of the contents, construction, legibility, and attractiveness, (3) instrument teacher responses aspect the suitability of the content of the material with KI and KD, readability, and attractiveness, and (4) student responses to the readability and attractiveness aspect of the e-book on the chemical equilibrium material being developed.

### Data analysis technique

The data analysis technique is a questionnaire data analysis of teacher and student needs during the preliminary study, the first stage namely classifying the data, then tabulating the data based on the classification made to provide an overview of the frequency and tendency of each answer based on the teacher and student needs analysis questionnaire. The next step is to calculate the percentage of answers to see the percentage of each answer to the questions given, so that the data obtained can be analyzed and explain the results of the percentage of respondents' answers in descriptive narrative form. The formula used is as follows:

$$\%J_{in} = \frac{\sum Ji}{N} \times 100\% \quad (\text{Sudjana, 2005})$$

Information:

$\%J_{in}$  = Percentage of answer choices-i

$\sum Ji$  = Number of respondents who answered-i

$N$  = Total number of respondents

The next step is to analyze the data from expert validation, teacher responses, and student responses, which is done by coding and classifying data to group answers based on questionnaire questions. After that, tabulate the data based on the data classification made and score the respondents' answers based on the Likert scale.

**Table 1.** Scoring based on Likert scale

| No | Answer Options          | Score |
|----|-------------------------|-------|
| 1  | Strongly agree (SS)     | 5     |
| 2  | Agree (S)               | 4     |
| 3  | Disagree (KS)           | 3     |
| 4  | Disagree (TS)           | 2     |
| 5  | Strongly disagree (STS) | 1     |

Then calculate the percentage of questionnaire answers on each item using the following formula:

$$\%X_{in} = \frac{\sum S}{S_{maks}} \times 100\% \quad (\text{Sudjana, 2005})$$

Information:

$\%X_{in}$  = Percentage of questionnaire answers.

$\sum S$  = Total score of answers.

$S_{maks}$  = Maximum expected score.

After knowing the percentage of answers to the questionnaire, the next step is to calculate the average percentage of answers to each questionnaire to determine the level of suitability of the content, construction, readability, and attractiveness of the e-book on chemical equilibrium material with the following formula:

$$\overline{\%X_l} = \frac{\sum \%X_{in}}{n} \quad (\text{Sudjana, 2005})$$

Information:

$\overline{\%X_l}$  = Average percentage of answers to statements in the questionnaire.

$\sum \%X_{in}$  = Total percentage of answers to all statements in the questionnaire.

$n$  = Number of statements in the questionnaire.

After obtaining the average percentage, then interpreting the average percentage of answers to the questionnaire as a whole using interpretation (Arikunto, 2008).

**Tabel 2.** The Interpretation of the percentage of the questionnaire

| Percentage | Criteria  |
|------------|-----------|
| 80.1 – 100 | Very high |
| 60.1 – 80  | High      |
| 40.1 – 60  | Moderate  |
| 20.1 – 40  | Low       |
| 0.0 – 20   | Very low  |

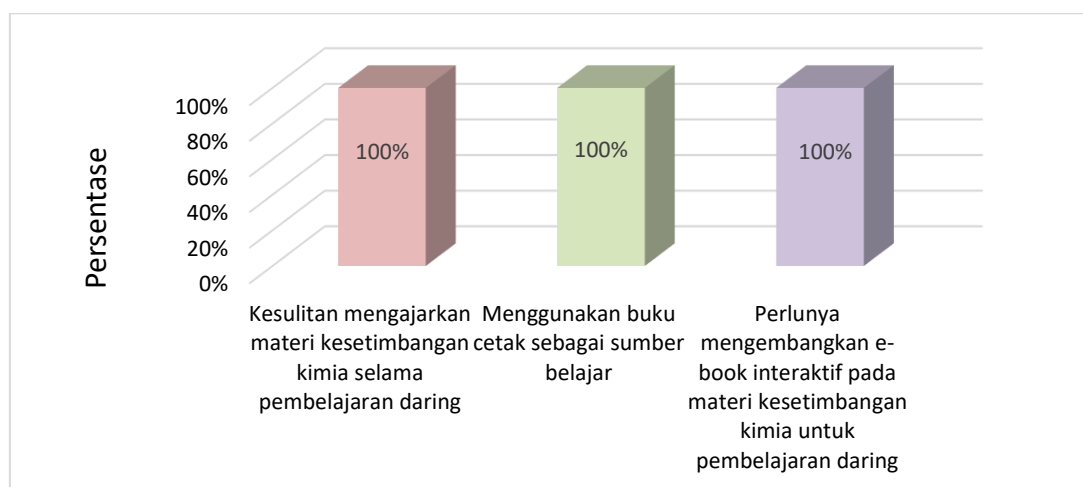
## ▪ RESULT AND DISCUSSION

### Research Result and Information Gathering

The results of the literature study consist of the results of literature studies and curriculum studies. The literature study was carried out by looking for various references regarding the ideal e-book and looking for supporting journals that were used as references regarding the difficulties of learning chemistry in chemical equilibrium material during online learning. Based on research conducted by Yuniasti (2019), the factors that cause students to have difficulty understanding chemical equilibrium material are due to the lack of learning resources owned by students and the teacher's way of delivering chemical material. the results of the curriculum study are analyzing core competencies (KI) and basic competencies (KD), namely KD 3.8 and 4.8, class XI MIPA in chemistry materials, chemical equilibrium materials.

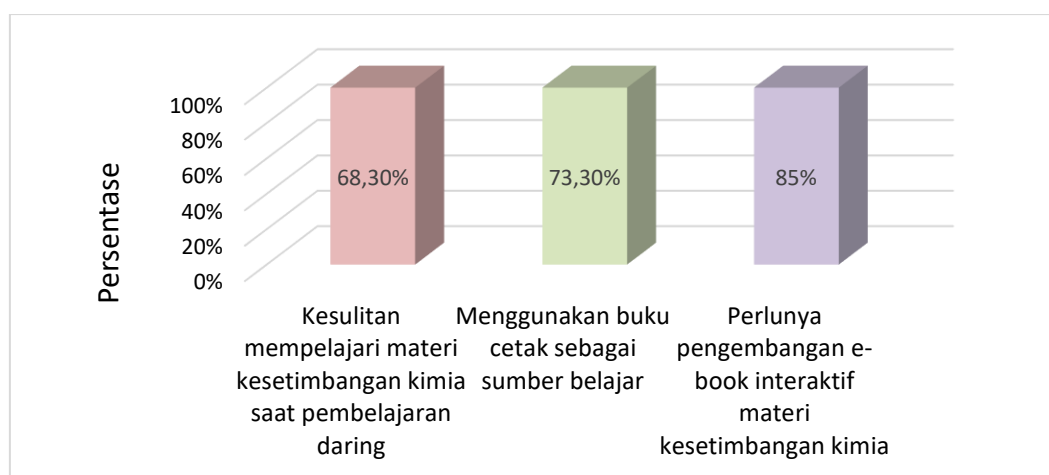
A preliminary study was conducted in three high school, namely SMA / MA in Bandar Lampung that MAN 2, SMA 10 and SMA 15 with filling the questionnaire is online using googleforms by three chemistry teacher from each school and 60

students who come from three schools. Based on the results of the analysis showed the need for teachers in figure 1 below.



**Figure 1.** Results of the needs analysis of teachers

It was found that 100% of the teacher respondents had difficulty teaching chemical equilibrium material during online learning during the covid-19 pandemic. This is reinforced by previous research conducted by Asmuni (2020) that the change in the learning system from offline to online resulted in the unpreparedness of teachers in following learning changes. All teachers use printed books during online learning to teach chemical equilibrium material. As many as 100% of teachers said it was necessary to develop an e-book on chemical equilibrium material for online learning during the covid-19 pandemic, so that students can more easily learn chemical equilibrium material. The results of filling out the needs analysis questionnaire for students can be seen in Figure 2 below.



**Figure 2.** Results of needs analysis of students

It was found that 73.3% of students used printed books during online learning to study chemical equilibrium material. Then 68.3% of students who have difficulty learning the chemical equilibrium material during online learning. This finding is

supported by the opinion of Zahro & Ismono (2021) which states that the delivery of material that is only done online causes the explanation of the chemical equilibrium material given by the teacher to be less understandable to students. Furthermore, 85% of students stated the need to develop an e-book during the covid-19 pandemic to make it easier for them to learn chemical equilibrium material. According to research conducted by Wilyanti, LS, Larlen, and Suryani (2021) that the development of e-book aims to help support and assist online learning during the pandemic.

### **e-Book Product Design Results**

In designing an e-book product, it is necessary to determine the application used to create an e-book. The application used in making e-books is book creator. The book creator was chosen because it is easy to use by teachers and students. This is reinforced by research conducted by Hess (2019) that book creators have a display that is easy to use by users and has various interesting features. In addition to determining which applications are used, do also pe mbuat an storyboard that contains the components of the e-book. The components designed consist of three parts, namely the introduction, the content, and the closing.

### **Early Product Development Results**

The e-book development sections consist of three parts. The first part is the introduction which contains the cover, introduction, table of contents, basic competencies (KD) and indicators of competency achievement, as well as a concept map. The second part is the content section, in the content section there is a description of the material that begins with the phenomenon of chemical equilibrium. Submission of material consisting of the concept of chemical equilibrium, dynamic equilibrium, homogeneous and heterogeneous equilibrium, equilibrium constant (K), and the relationship between  $K_p$  and  $K_c$  values. In the dynamic equilibrium material there are videos of  $\text{NO}_2$  gas experiments and  $\text{NO}_2$  gas animations. Then in each material discussed there are examples of questions and their discussion. At the end of all the material there is a summary of the material that has been discussed previously. There are also evaluation questions in the form of 15 multiple choice questions and 5 essay questions. The third part is the closing section which contains the references and the back cover of the e-book which contains a description of the e-book and the profile of the e-book developer.

### **Expert Validation Result**

After compiling the e-book, the next step is to ask for criticism and suggestions on aspects of content suitability, construction aspects, readability aspects, and attractiveness aspects. The validation was carried out by three lecturers of chemistry education at the University of Lampung. The results obtained can be seen in Table 3.

**Table 3.** Expert Validation Results

| <b>Rated aspect</b>        | <b>Average percentage (%)</b> | <b>Criteria</b> |
|----------------------------|-------------------------------|-----------------|
| <b>Content suitability</b> | 76.29%                        | High            |
| <b>Construction</b>        | 82.95%                        | Very high       |
| <b>Legibility</b>          | 82.22%                        | Very high       |
| <b>attractiveness</b>      | 83.8%                         | Very high       |

In the aspect of content suitability, it has an average percentage of 76.29 with high criteria. The construction aspect has an average percentage of 82.95, the readability aspect has an average percentage of 82.22, and the attractiveness aspect has an average percentage of 83.8 with very high criteria. The developed e-book is said to be valid because it has high and very high criteria. In line with research conducted by Nurmayanti, Rosilawati, & Fadiawati (2017) that the e-book developed has high and very high criteria, therefore the resulting product is valid and suitable to be used as a learning resource.

There are several suggestions given by the validator. In the aspect of suitability, there are parts that are repaired, previously there were no learning objectives. On the construction aspect, the validator said it was better to use hyperlinks in the table of contents to make it easier to find the part to be studied. The color of the previous e-book content was green and orange, the validator suggested changing the color of the e-book content because it was not suitable. The e-book content color is changed to dark blue and light gray. On the aspect of readability, the Validator suggests increasing the font size, the previous font size using a font size of 16 was changed to 20. On the aspect of attractiveness, it is recommended to repair the front cover because the combination of circles and squares does not match. Initially the cover consisted of two circular images. After being revised, the cover consists of 5 square-shaped images. After being validated, the researcher revised the rough draft of the e-book and consulted with the supervisor. Then the revised e-book draft was tested on a limited basis.

#### Limited Trial Results on Teachers and Students

The limited trial was conducted on 5 teachers of class XI MIPA from three different SMA/MA, two teachers from SMAN 15 Bandar Lampung, two teachers from MAN 2 Bandar Lampung, and one teacher from SMAN 13 Bandar Lampung. The percentage of the results of the trial limited to teachers can be seen in Table 4.

**Table 4.** Limited Trial Results on Teachers

| <b>Rated aspect</b>   | <b>Average percentage (%)</b> | <b>Criteria</b> |
|---|-------------------------------|-----------------|
| <b>Conformity of the content of the material with KI-KD</b> | 86.67%                        | Very high       |
| <b>Legibility</b>   | 85.60%                        | Very high       |
| <b>attractiveness</b>                                       | 86.80%                        | Very high       |

The average percentage on the aspect of conformity of the content of the material with KI-KD is 86.67% and has very high criteria. The average percentage of the test results is limited to the readability aspect, which is 85.60% with very high criteria. The average percentage on the attractiveness aspect is 86.80% with very high criteria. From the results of the limited trial on teachers, the percentage in all aspects has very high criteria. There was no suggestion given by the teacher, so there was no revision of the test results and the revised e-book product draft from the validator was the final draft of product development.

Then, a limited trial was conducted on 63 students of SMA Class XI MIPA from three schools, namely SMAN 15 Bandar Lampung, MAN 2 Bandar Lampung, and

SMAN 13 Bandar Lampung. The percentage of limited trial results on students can be seen in Table 5.

**Table 5.** Limited Trial Results on Students

| Rated aspect          | Average percentage (%) | Criteria  |
|-----------------------|------------------------|-----------|
| <b>Legibility</b>     | 84.5%                  | Very high |
| <b>attractiveness</b> | 83.9%                  | Very high |

The average percentage of the results of the limited test for students in the readability aspect was 84.5% with very high criteria. The average percentage of the results of the limited trial to students in the attractiveness aspect is 83.9% with very high criteria. From the results of the limited trial, the average percentage on the readability aspect and the attractiveness aspect for students has very high criteria. Students said the e-book developed was interesting and well read, and easy to use.

## ▪ CONCLUSION

Based on the results of the research and discussion, it was concluded that (1) the results of expert validation of the e-book product on the chemical equilibrium material developed obtained an average percentage of 76.29% for the aspect of conformity with the high criteria. The average percentage is 82.95% for the construction aspect, 82.22% for the readability aspect, and 83.8% for the attractiveness aspect, all three have very high criteria. From the results of expert validation of the developed e-book product, it is said to be valid because the average percentage of each aspect has high and very high criteria, (2) Based on the results of the teacher's responses, the average percentage is 86.67% for the aspect of conformity of the content of the material with KI-KD, 85.6% for the readability aspect, and 86.8% for the attractiveness aspect, all three have very high criteria, (3) Based on the results of student responses to the development of e-books on chemical equilibrium material, the average percentage of results is 84.5% for the readability aspect and 83.9% for the attractiveness aspect, both have very high criteria.

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