

Development of Chemo-Entrepreneurship Book Entitled “*Peduli Lokal, Melek Global*”: Popularizing Chemistry and Developing Life Skills in Industrial Revolution Era 4.0

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Abstract: The entrepreneurship course in Chemistry Education or Tadris Kimia study program at three universities in South Kalimantan (Universitas Islam Negeri Antasari Banjarmasin, Universitas Lambung Mangkurat (ULM), and Universitas Islam Kalimantan Muhammad Arsyad Al Banjari Banjarmasin (UNISKA)) has not integrated chemistry studies. In addition, there is also no chemo-entrepreneurship book that can be used as a reference in the entrepreneurship course. Therefore, a Research and Development (R&D) was carried out to develop a chemo-entrepreneurship book on local care and global literacy as an effort to popularize chemistry and develop life skills in the industrial revolution era 4.0. The book was developed using the Borg and Gall model with the modification of the study steps only to the limited trial stage. Based on the results, the book (chemo-entrepreneurship book entitled “peduli lokal, melek global”) is very valid and feasible to use (revision according to suggestions), besides being practical with a good linguistic aspect.

Keywords: Development of Chemo-entrepreneurship, *Peduli lokal Melek global*, Popularizing Chemistry, Life Skills

1. Introduction

The world is now starting to enter the industrial revolution era 4.0. In this era, changes occur in the concepts, structures, and competencies needed by the world of work. Not only in the world of work, human resources are also required to immediately make adjustments and self-development so as not to be crushed by the fast pace of innovation from the industrial revolution era 4.0. One form of adjustment and self-development to face the industrial revolution era 4.0 is to improve life skills in the form of 21st century skills consisting of 4-C (Zubaidah, 2018).

Students as part of the community are required to immediately make adjustments to the development of the industrial revolution era 4.0 (Unilak Magazine 2018). Through universities, students are assisted to make adjustments and self-development in order to face the industrial revolution era 4.0. One form of assistance from universities in self-development is the entrepreneurship course. This course is in line with higher education policies in the industrial revolution era 4.0 where entrepreneurship is a mandatory study accompanied by integration with skills such as critical thinking skills (Kemdikbud, 2022). South Kalimantan has 3 Universities that are well known and with a large number of students, namely Universitas Islam Negeri Antasari Banjarmasin, Universitas Lambung Mangkurat (ULM), and Universitas Islam Kalimantan Muhammad Arsyad Al Banjari Banjarmasin (UNISKA). All three universities have the same study program, namely Chemistry Education study program or at UIN Antasari Banjarmasin called Tadris Kimia. Tadris Chemistry study program of UIN Antasari Banjarmasin until the academic year 2019/2020 has 48 students, Chemistry Education study program of ULM has 297 students, and Chemistry Education study program of UNISKA has 90 students.

Based on the results of unstructured interviews December 2019 with the head of study program, lecturers, and staff of Chemistry Education or Tadris Kimia study program from the three universities, there are no graduates in the Tadris Kimia study program. Although there are no graduates yet, the Tadris Kimia study program has stated in its vision to produce an excellent Bachelor of Chemistry Education at the national level in 2024 with two missions, namely (1) conducting chemistry education through Islamic learning, student-centered and based on local wisdom; and (2) conducting periodic entrepreneurship-based learning and training in the field of chemistry education.

The Chemistry Education study program of ULM and UNISKA has produced many graduates with the average waiting period to get a job is 0 (zero) to 6 months with fields of work from education (Chemistry/IPA teachers) as honorary staff or permanent civil servants and non civil servants, laboratory assistants, companies both related to chemistry and or not related to chemistry, BUMD and BUMN, as well as self-funding (entrepreneurs). This information certainly shows that graduates of the Chemistry Education study program can join the world of work in any field, including entrepreneurship. The field of entrepreneurship carried out by graduates of Chemistry Education study program, especially at ULM and UNISKA, includes online businesses (online sales), perfume seed businesses, sasirangan craftsmen and sellers, as well as providers of science laboratory equipment and materials.

Entrepreneurship is a process of applying creativity and innovation in solving problems and finding opportunities to improve business life (Seftari 2018) (Pazicni and Flynn 2019). The entrepreneurship course is presented because of the demands in educational institutions including universities to be able to produce graduates who have added value according to the needs of the labor market, and produce graduates with character, competence and innovation (Unilak Magazine 2018).

Entrepreneurship course in Tadris Chemistry study program and Chemistry Education is held in semester 3 at UNISKA, semester 6 at ULM, and semester 7 at UIN Antasari with a total of 2 credits. The entrepreneurship course at the Tadris Kimia study program at UIN Antasari Banjarmasin has not been given because the students have only reached semester 6, while in the Chemistry Education study program of ULM and UNISKA, the entrepreneurship course has not fully integrated entrepreneurship with chemistry. In addition, there are also no books on entrepreneurship about chemistry and local and global potentials available.

Integrating the entrepreneurship course with chemistry studies, especially for students of the Chemistry Education or Tadris Chemistry study program is important and useful, considering that chemistry studies have contributed significantly to the development of human civilization (Moore 2000). One approach that can be used in integrating entrepreneurship with chemistry studies is chemo-entrepreneurship (Arfin, Latisma, and Oktavia 2018) (Fisher 2012).

Based on these facts, the researchers were interested in developing reading books that can also be used as teaching materials (textbooks) through a development study entitled Development of Chemo-Entrepreneurship Book

Entitled “Peduli Lokal, Melek Global”: Popularizing Chemistry and Developing Life Skills in Industrial Revolution Era 4.0, with the target audience are students of Chemistry Education or Tadris Chemistry study program and the general public.

2. Methods

This study is included into Research and Development (R&D) study. According to (Sugiyono 2010), this method is used to produce products and test their effectiveness. This study used the Borg & Gall model consisting of 10 steps, but was modified by the researchers into 7 steps to shorten the time and budget. The seven (7) steps are (1) potential and problem analysis, (2) data collection, (3) product design, (4) product validation, (5) product revision, (6) limited trial, and (7) evaluation revisions as product improvements resulting from limited trials. The following is a chart of the study steps carried out (can be seen in Figure 1):

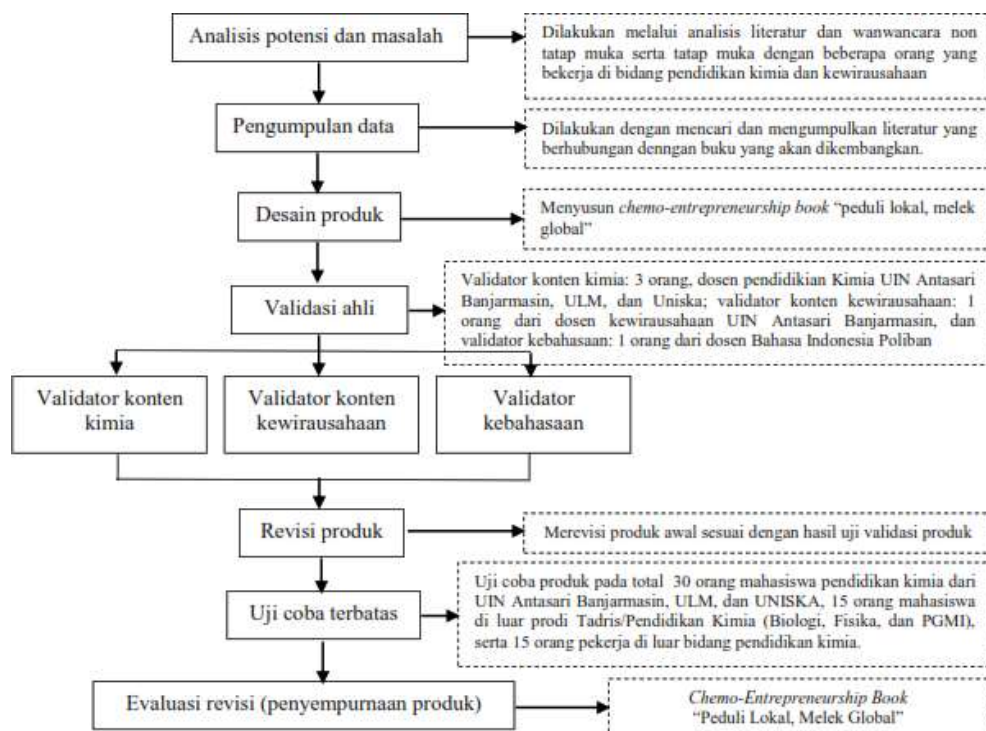


Figure1. Development Steps of Chemo-Entrepreneurship Book Entitled “Peduli Lokal, Melek Global”

The subjects of the study were chemistry content experts, entrepreneurship content experts, linguists, and students from the Tadris Kimia or Chemistry Education Study Program at UIN Antasari Banjarmasin, ULM, UNISKA, and the general public (not students of the Tadris Kimia or Chemistry Education Study Program) for a limited test. Meanwhile, the object of study was Chemo-entrepreneurship Book “Peduli Lokal, Melek Global” dcompiled based on the literature then validated and tested on a limited basis. There are two kinds of validation used in this study, namely:

Expert validation

Expert validation for the chemo-entrepreneurship book was carried out by 5 experts consisting of 3 chemistry lecturers (chemistry content experts from UIN Antasari Banjarmasin, ULM, and UNISKA), 1 entrepreneurship lecturer (entrepreneurship content expert and entrepreneurship actors from UIN Antasari Banjarmasin), and 1 Indonesian language lecturer (linguist of Politeknik Negeri Banjarmasin). Validation was carried out online, where all validators were given a chemo-entrepreneurship book draft and an assessment questionnaire link to validate the book developed.

a. Trial

The trial was carried out online by sending a chemo-entrepreneurship book draft (chemo-entrepreneurship book) and a trial questionnaire to 30 students of the Tadris Kimia or Chemistry Education Study Program consisting of 10 students of Tadris Kimia UIN Antasari Banjarmasin, 10 students of Chemistry Education Study Program ULM, and 10 students of Chemistry Education Study Program UNISKA. In addition, the chemo-entrepreneurship book and a trial questionnaire were also sent to 30 people, consisting of 15 students outside the Tadris Kimia or Chemistry Education Study Program (Biology, Physics, and PGMI), and 15 workers.

b. Data Collection Technique

Data were collected using a chemo-entrepreneurship book and questionnaires for expert validation, limited trials, and Focus Group Discussion (FGD). This study used a questionnaire to determine the validity and practicality of the book. The questionnaire was developed according to the following indicators.

Table 1. Assessment Indicators of Chemo-Entrepreneurship Book Entitled “Peduli Lokal, Melek Global” for Chemistry Content Expert

No	Indicator
1	The suitability of the chemistry material presented with product examples in the book
2	Design and appearance
3	Linguistic aspect
4	The benefits of books in popularizing chemistry and motivating to develop life skills in the industrial revolution era 4.0

Table 2. Assessment Indicators of Chemo-Entrepreneurship Book Entitled “Peduli Lokal, Melek Global” for Entrepreneurship Content Expert

No	Indicator
1	The suitability of the entrepreneurship material presented
2	The suitability of the product examples described in the book with the surrounding environment (local care) and the global community (global literacy)
3	Design and appearance
4	Linguistic aspect
5	The benefits of books in popularizing chemistry and motivating to develop life skills in the industrial revolution era 4.0

Table 3. Assessment Indicators of Chemo-Entrepreneurship Book Entitled “Peduli Lokal, Melek Global” for Linguists

No	Indicator
1	Design and appearance
2	Linguistic aspect
3	The benefits of books in popularizing chemistry and motivating to develop life skills in the industrial revolution era 4.0

Table 4.a Assessment Indicators of Chemo-Entrepreneurship Book Entitled “Peduli Lokal, Melek Global” for Limited Trial consists of Practicality and Readability Test

No	Indicator
1	Interest in the book
2	Selection of words and sentences in the book

- 3 Book content
- 4 Linguistic aspect

Table 4.b Assessment Indicators of Chemo-Entrepreneurship Book Entitled “Peduli Lokal, Melek Global” for Limited Trial on Reader Response (Questionnaire with Open Questions)

No	Indicator
1	Ease of understanding the book developed
2	Constraints in using the book developed
3	Interests in the book developed
4	Clarity of images presented in the book developed
5	The ability of images used in clarifying the material
6	The benefits of books for readers to know and understand entrepreneurship
7	The usefulness of the book developed for readers to recognize and understand chemistry
8	The usefulness of the book developed for readers to recognize, understand and motivate to develop life skills in the industrial revolution era 4.0
9	Benefits of the book developed
10	Components that need to be fixed in the book developed

The discussion in this study refers to the results of the analysis using the descriptive quantitative technique. The data analyzed were questionnaires filled by chemistry content experts, entrepreneurship content expert, and linguist, students of the Tadris Kimia or Chemistry Education Study Program, and the general public.

a. Expert Validation

Expert validation was analyzed by the following steps (Sugiyono, 2010):

1. Calculate the validity of the questionnaire filled by expert with the following formula:

$$x (\%) = \frac{\textit{Total score}}{\textit{Maximal total score}} \times 100\%$$

2. Calculate the average validity using the following formula

$$x (\%) = \frac{\textit{Total percentage}}{\textit{number of validators} * } \times 100\%$$

3. The results are categorized with the validity criteria presented in Table 5

Table 5. Validity Criteria

Skor	Description
85.00 - 100 %	Very valid
70.00 - < 85.00 %	Quite valid
50.00 - < 70.00 %	Less valid

Source: adapted from Akbar (2013)

b. Product Trial (Practicality Test and Reader Response)

Practicality test questionnaire was analyzed by the following steps (Sugiyono, 2010):

1. Calculate the validity of the questionnaire filled by expert with the following formula

$$x (\%) = \frac{\text{Total score}}{\text{Maximal total score}} \times 100\%$$

2. Calculate the average validity using the following formula:

$$x (\%) = \frac{\text{Total percentage}}{\text{number of respondents}} \times 100\%$$

3. The results are categorized with the validity criteria presented in Table 6

Table.6 Criteria for Practicality and Readability Test

Score	Category
85-100%	Very good
70 - < 85%	Good
60 - < 70%	Quite good
50 - < 60%	Bad
< 50%	Very Bad

Source: Sugiyono (2010)

In addition to the practicality test (including the readability test), a recapitulation of the response to the book was also carried out (chemo-entrepreneurship book entitled “Peduli Lokal, Melek Global”). Based on the results of the recapitulation, the researcher will draw conclusions about the response to the book developed.

3. Results and Discussion

a. Validity of Chemo-Entrepreneurship Book Entitled “Peduli Lokal, Melek Global”: Popularizing Chemistry and Developing Life Skills in Industrial Revolution Era 4.0

The chemo-entrepreneurship book developed has been validated by experts from chemistry content experts, entrepreneurship content expert, and linguist. Expert validation was carried out to review the book developed and provide input for improvements to the book developed. According to the Ministry of National Education (2008), expert validation is carried out to obtain validation or acknowledgment that the product developed is feasible for use in learning. This expert validation is also in line with Arifin (2013) that the product developed must be validated first by the expert validators to determine the feasibility of the learning media developed. The validity results of the chemistry content expert can be seen in Table 7.

Table 7. Validity Results of Chemistry Content Expert

No.	Indicator	Average Percentage (%) per Indicator	Average Percentage (%)
1	The suitability of the chemistry material presented with product examples in the book	98.33 (Very Valid)	94.24
2	Design and appearance	92.50 (Very Valid)	
3	Linguistic aspect	94.44 (Very Valid)	
4	The benefits of books in popularizing chemistry and motivating to develop life skills in the industrial revolution era 4.0	91.67 (Very Valid)	
Conclusion of chemistry content expert			Very Valid

Source: Data Processing Results

Suggestions and conclusions regarding the feasibility of the book from chemistry content experts can be seen in Table 8.

Table 8. Suggestions for Revision

Validator 1	Book Feasibility
Suggestions for Revision 1. There are some blurry or broken images and tables (3.33; 3.37). 2. There are some unfamiliar terms such as stratum corneum that have not been explained in the glossary	Feasible to use with revisions according to suggestions

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3. There are some mistakes in writing words
 4. Images should be accompanied by an explanation, as in the images of the fructose structure (4 images).
 5. There are some image names that are not spaced with new paragraphs (eg: 3.34 etc.)
 6. The link is still written in blue, please note.
 7. The position and size of the "chemistry corner" font might be reconsidered.

Validator 2

1. Pay attention to the layout of the book.
2. Pay attention to the writing spacing
3. Use scientific language.
4. Complete the glossary

Feasible to use with revisions according to suggestions

Validator 3

Check the bibliography again. Please clarify the images for the chemistry structures

Feasible to use with revisions according to suggestions

Source: Data Processing Results

Suggestions and conclusions regarding the feasibility of the book from entrepreneurship content expert can be seen in Table 9.

Table 9. Suggestions for Revision

Suggestions for Revision	Book Feasibility
The presentation of the material is good and clear as a book integrating chemistry with daily life and entrepreneurship. However, the images are too small and difficult to read. It is very good and feasible	Feasible to use with revisions according to suggestions

Source: Data Processing Results

Validity Results of linguist can be seen in Table 10.

Table 10. Validity Results of linguist

No	Indicator	Percentage (%) Per Indicator	Average Percentage (%)
1	Design and appearance	97.50 (Very Valid)	
2	Linguistic aspect	97.22 (Very Valid)	98.24
3	The benefits of books in	100 (Very Valid)	

popularizing chemistry and motivating to develop life skills in the industrial revolution era 4.0

Conclusion of linguist

Very Valid

Source: Data Processing Results

Suggestions and conclusions regarding the feasibility of the book from linguist can be seen in Table 11.

Table 11. Suggestions for Revision and Book Feasibility

Suggestions for Revision

Book Feasibility

There are at least 21 misspellings that need to be corrected. (can be seen in the attachment)

Feasible to use with revisions according to suggestions

Source: Data Processing Results

Based on the results of the assessment by 5 validators, the book developed was very valid and feasible to use with revisions according to suggestions. The revisions given by the validators were more directed at writing and spelling, in addition to the presentation of images supporting the explanation of the material, and the clarity of the references used (references cited must be written in the bibliography). The form of follow-up carried out by the researcher was to revise based on the suggestions given by the validators.

After validation and revision, the book developed was discussed in FGD. The results of the FGD provide suggestions for improving the book in terms of writing, content layout and cover design. Several other suggestions related to language, where some of the participants felt that the language (words and sentences) presented in the book still looked standard so that it could affect the reader's understanding outside the field of chemistry. Another interesting suggestion that has not been followed up at this time is the addition of verses from the Qur'an or hadiths related to the material studied in the book.

Suggestions regarding the use of these verses or hadiths are not followed up by researchers in the development of this book because including these verses and/or hadiths requires a special study (tafsir al-Qur'an and hadith) in order to find a match between the verses and/or arguments used with the material presented in the book. However,

suggestions regarding these verses and/or hadiths will be followed up by researchers for the development of a follow-up book from this chemo-entrepreneurship book.

The FGD implementation showed a positive impression and the participants stated that they got benefits and new knowledge regarding the preparation of a book, entrepreneurship materials, studies of local wisdom (local culture), and global development.

b. Practicality (Readability) and Response on Chemo-Entrepreneurship Book Entitled “Peduli Lokal, Melek Global”: Popularizing Chemistry and Developing Life Skills in Industrial Revolution Era 4.0

The revised book is then used in the limited trial phase. The tests carried out are practicality tests, including readability. The practicality of the book is seen from several aspects related to the use of the book, namely (1) the interest of readers (students or the general) towards the book, (2) the choice of words and sentences in the book, (3) the content of the book, and (4) language. This linguistic aspect or indicator becomes a measure of the readability of the book.

The limited trial was carried out on 60 people who were randomly selected and divided into two categories, namely (1) from the field of chemistry, represented by 30 students of the chemistry education study program at UIN Antasari Banjarmasin, UNISKA, and ULM, (2) from the field of non-chemistry (general public), represented by 15 students outside the field of chemistry. These students come from the Physics Study Program, Biology Study Program, and PGMI UIN Antasari Banjarmasin. While the other 15 people were from the general public whose educational and work backgrounds are not in the field of chemistry and/or chemistry education. The results are as follows

Practicality Results by Chemistry Respondents The practicality (readability) results can be seen in Table 12.

Table 12. Practicality Results (Readability) by Chemistry Respondents

No	Indicator	Average Percentage (%) per Indicator	Average Percentage (%)
1	Interest in the book	88.33 (Very Good)	85.12
2	Selection of words and	81(Good)	

	sentences in the book		
3	Book content	87.81(Very Good)	
4	Linguistic aspect	83.33(Good)	
Conclusion of Practicality Results (Readability)			Very Good

Source: Data Processing Results

Practicality Results by Non-Chemistry Respondents

The practicality (readability) results can be seen in Table 14.

Table 14. Practicality Results (Readability) by Non-Chemistry Respondents

No	Indicator	Average Percentage (%) per Indicator	Average Percentage (%)
1	Interest in the book	85.83 (Very Good)	
2	Selection of words and sentences in the book	79.83(Good)	84.09
3	Book content	87.50(Very Good)	
4	Linguistic aspect	83.21(Good)	
Conclusion of Practicality Results (Readability)			Good

Source: Data Processing Results

Response of Chemistry Respondents

The responses of chemistry respondents can be seen in Table 15.

Table 15. Response of Chemistry Respondents

No	Indicator	Conclusion
1	Ease of understanding the book developed	Easy to understand
2	Constraints in using the book developed	No problem
3	Interests in the book developed	Very interesting
4	Clarity of images presented in the book developed	Interesting, but some images are not clear
5	The ability of images used in clarifying the material	Yes, can clarify the material
6	The benefits of books for readers to know and understand entrepreneurship	Very helpful
7	The usefulness of the book developed for readers to recognize and understand chemistry	Very helpful
8	The usefulness of the book developed for readers to recognize, understand and	Very helpful and motivating

motivate to develop life skills in the industrial revolution era 4.0

9	Benefits of the book developed	Easy to understand, the sentences are neatly arranged and very standard, and the presentation of the material is complete
10	Components that need to be fixed in the book developed	The explanation of the chemistry field is still lacking, there are still errors in writing, some images look less clear, and the font type is monotonous

Source: Data Processing Results

Response of Chemistry Respondents

The responses of non-chemistry respondents can be seen in Table 16

Table 16. Response of Non-Chemistry Respondents

No	Indicator	Conclusion
1	Ease of understanding the book developed	Easy to understand
2	Constraints in using the book developed	There are no significant obstacles, need to improve the layout
3	Interests in the book developed	Very interesting, because it discusses local culture and global developments
4	Clarity of images presented in the book developed	Interesting, but the proportion of images seems inconsistent
5	The ability of images used in clarifying the material	Can support material clarity
6	The benefits of books for readers to know and understand entrepreneurship	Very helpful, but it is necessary to add an explanation in the communication section, especially in relation to the advantages of the product compared to products already on the market

7	The usefulness of the book developed for readers to recognize and understand chemistry	It helps, because the authors try to explain the content of the ingredients used in the processing of the product, even some reactions are presented
8	The usefulness of the book developed for readers to recognize, understand and motivate to develop life skills in the industrial revolution era 4.0	Yes very helpful
9	Benefits of the book developed	Easy to understand, interesting material, integrating exact science and socio-culture, language is easy to understand even though using standard language
10	Components that need to be fixed in the book developed	The cover and layout are not attractive, sometimes there are some paragraphs that are too long, there are still typos, and it is better to add an Islamic perspective to add to the characteristics of UIN, and blurry images can be corrected

Source: Data Processing Results

Based on the results of the limited trial, interest in the book and book content are the best aspects. These results are equally good for respondents of chemistry and non chemistry. The same results were also obtained for the selection of words and sentences in the book as well as the linguistic aspect, where the results obtained were in a good category. In conclusion, it can be stated that the book developed was practical to use (read and/or studied) as well as from a linguistic aspect. The average percentage of the two categories of respondents (60 people) for the practicality test (readability) was 84.65% or was in a good category. The overall reader response to the book developed shows a positive response, such as:

- a) Easy to understand the book
- b) There are no obstacles to using the book;
- c) The book developed is interesting;

- d) Images are presented clearly, images that are not clearly visible can attract the curiosity of readers to seek further information about the images presented;
- e) Images can clarify the material/topics presented;
- f) The book really helps readers to recognize and understand entrepreneurship;
- g) The book really help readers to recognize and understand chemistry;
- h) The book is very helpful and motivate readers to develop life skills in the industrial revolution era 4.0;
- i) The book developed is easy to understand, the sentences are neatly arranged and very standard, and the presentation of the material is complete and interesting.

In addition to the positive response, there are suggestions for improvement before the book is sent to publishers such as;

- a) Lack of explanation in the field of chemistry;
- b) There are still errors in writing;
- c) There are still some unclear images;
- d) Monotonous font type;
- e) Unattractive cover and layout;
- f) Some paragraphs are too long;
- g) It is better to add an Islamic perspective as a characteristic of UIN.
- h) Not all suggestions obtained are followed up directly but are used as material for consideration for the next book developed. Suggestions that are not followed up directly listed in numbers 4 and 7.

4. Conclusion

Based on the results, the book (chemo-entrepreneurship book entitled “peduli lokal, melek global”) is very valid and feasible to use (revision according to suggestions), besides being practical with a good linguistic aspect.

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