International Journal of STEM Education for Sustainability, Vol.3, No.1, 2023, pp. 125-138
e-ISSN 2798-5091. DOI. 10.52889/ijses.v3i1.110

Development of STEM Based-Integrated Electrochemistry Enrichment Book: An Analysis Review

Submitted 10 April 2022, Revised 25 June 2022, Accepted 28 June 2022

Tami Triayuni[1], Dedi Irwandi[2*], Buchori Muslim[3]

[1,2,3]Department of Chemistry Education, Faculty of Tarbiya and Teaching Sciences,
Universitas Islam Negeri Syarif Hidayatullah Jakarta, Tangerang Selatan, Indonesia
Corresponding Email: *dedi.irwandi.yuskar@uinjkt.ac.id

Abstract

The research aimed to develop a STEM-based chemistry enrichment book on electrochemistry and find out the students' responses to the book. This development process uses a mixed method Cresswell version; qualitative approach for the development stage using text analysis and quantitative method for data statistics using data analysis. An enrichment book indicator is generated, which has been integrated with each STEM component to become a reference for developing an enrichment book. Then, a STEM-based chemical enrichment book was made on electrochemical materials. It was reviewed by expert validation of media materials: four chemistry education lecturers and one chemistry teacher. The average percentage from enrichment book validation results for each aspect of eligibility were: content, presentation, language, and graphics. Each has a value of 98.5%, 87.5%, 100%, and 100%. The final enrichment book product was tested on 37 students at one of the senior high schools in Indonesia. The student's response test results were 81.34%, including the proper category in a very good predicate. The product of this study result was proven to have a positive response that can be used in chemistry learning. It can be used as teaching material for schools and also can support STEM education in Indonesia.

Keywords: Enrichment book, Electrochemistry, STEM

INTRODUCTION

Industry 4.0 is an era of human work system transformation that is an agricultural and manual system previously into an industrial and digital system. In this era, the "automation" system developed by merging the internet with machine tools in an enormous scope. The development of computers, artificial intelligence robots, transportation applications, intelligent factories, online buying and selling transactions, digital wallets, and others can characterize it. This makes daily human activities easier (Sima et al., 2020).

Industry 4.0 has become a pioneer of a new education system' formation called STEM. Industry 4.0 requires increased qualification in science, technology, engineering, and mathematical (STEM) domains to improve the qualified human resources (Kamsi et.al., 2019). The science and mathematics' concept used for reference and data analysis in the engineering process that will produce the technology product. A learning approach that produces the technological products as output is also needed, especially in the field of technology development in the industrial sector (Mathis, et. al., 2018).

Based on data from the U.S. Bureau of Labor Statistics 2019, it's predicted that occupations in the STEM field are expected to grow 8.0 percent by 2029, compared with 3.7 percent for all occupations (Zilberman & Ice, 2021). Therefore, it's necessary to develop

human resources with the knowledge, attitudes, and skill as a prerequisite of the Industry 4.0 era (Vrchota, et. al, 2020), which can be prepared to start from the primary and secondary education levels.

In Indonesia, educational goals refer to the 2013 Curriculum that includes cognitive, affective, and psychomotor development (Ministry of Education, 2014). The 2013 Curriculum also contains learning multidisciplinary, which supports the prerequisite ability of Industry 4.0; critical thinking, creativity, collaboration, and communication (Fikri et al., 2019). It provides opportunities for the implementation of STEM education that focuses on; the analysis of data, design and manufacture, product testing, and handling of obstacles in the product manufacturing process (Tunc & Bagceci, 2021). It makes cognitive, affective, and psychomotor aspects of 4C skills development can be measured (Purnawirawan et al., 2019). The STEM approach is in line with the demands and purposes of the 2013 Curriculum.

One way to realize it is to provide adequate educational facilities; teaching materials. Proper teaching materials are believed to be effective in arousing students' interest in learning and support for achieving good learning outcomes (Kurniawati et al., 2017). However, teaching materials are usually described in general only; less focused on applicative materials so the students cannot implement the lesson into daily life (Rusyati et al., 2019). Giani et al. (2015) argue that it's difficult to achieve cognitive abilities at levels C5 and C6 in Bloom Taxonomy because the exercise was rarely included it.

The availability of non-textual textbooks in several schools in Indonesia still needs to be improved. The Ministry of Education's rules instructs that each school needs to have a collection of 870 titles of enrichment books, consisting of 30% fiction books and 70% non-fiction books. Still, it turns only around 5.7% of schools have "varied" library infrastructure (Ministry of Education, 2018). This causes have been unable to encourage students to think at a higher level.

Another obstacle is the need for more student literacy interest. This is evident from the results of the 2018 PISA study, which states that Indonesia is ranked 74th out of 79 countries in the reading ability category (OECD, 2019). This is reinforced by data from the 2016 Indonesia National Assessment Program (INAP) that the average national literacy skills in science, mathematics, and reading are only 1.01%, 2.29%, and 6.06% (Ministry of Education, 2016). Based on this, it can be concluded that scientific, mathematical, and language literacy is less or has not yet become a priority for students.

The Association of Indonesian Internet Service Providers presents the survey result that internet users among elementary-high school students based on the Ministry of Education's

data in 2016 reached 45.1 million out of a total of 132.7 million internet users (Marius & Pinontoan, 2013). This proves that most students use technology to support the learning process. Therefore, learning is considered more efficient because accessing information is wider and faster. Technological literacy is expected to develop sustainably, so the implementation of the 2013 Curriculum runs effectively and maximally.

To overcome the phenomenon of students' low literacy interest, one way to do this is by increasing the four literacy in enrichment books; reading, science, mathematics, and technology. It can be developed by implementing the STEM concept. Developing an enrichment book into a subject can facilitate the learning of the study.

Some students think chemistry is challenging to learn directly because it's microscopic, like electrochemistry. It discusses electron flow rate in oxidation-reduction (redox) reactions. Electrochemistry learning should involve everyday activities based on chemical phenomena, not only on the theory in textbooks (Thummathong & Thathong, 2018). Therefore, chemistry teachers in Industry 4.0 should innovate to improve the learning system; thus, it can be seen directly (Suryaningsih et al., 2021).

STEM approach that focuses on finding solutions to contextual issues (Sutaphan & Yuenyong, 2019), also electrochemistry learning related to industrial processes in today's modern industry (Mainier et al., 2013), makes both of them can be integrated. The electrochemistry-STEM concept is also following the basic competency substances: analyze the electrochemical processes that occur (science); calculate the quantities associated with electrochemical cells (mathematics); design or carry out experiments related to electrochemical cell materials (engineering); and explain their uses (technology) (Ministry of Education, 2016).

This study aimed to analyze the making process of an electrochemical-STEM-based enrichment book. By developing a STEM-integrated electrochemistry enrichment book, it's hoped that the description of electrochemical material can be seen clearly and be learned well to meet the demands of basic electrochemical competence. It's also expected to support the 2013 Curriculum implementation and not be left behind with the development of the Industrial Revolution 4.0.

METHOD

The research used a mixed-method research design. The methods used in this research are (1) the Descriptive research method, which aims to describe information about the development process of the book, describe the validation data and the results of the product's

effectiveness; and (2) quantitative methods, used as data processing in this study (Creswell, 2009).

This research can be classified into descriptive research. A group of data from research is described to state the research results. Four data are described in this research; (1) data on the analysis of teacher needs for the development of STEM-based Electrochemistry enrichment book; (2) data on characteristics of students in terms of background, motivation, and interests for the book (3) validation data from media expert (4) data on student response test in limited field trials. Mixed method data involve statistical procedures and text analysis (Creswell, 2009). This study used validation and limited field trials data as statistical data, while student and teacher data interviews as a text analysis.

The sample in the research was high school teachers and a total of 37 students in the XII class from a senior high school in Tangerang. The sample of students was chosen by simple random sampling, where each person in the population has the same opportunity to be a sample subject, not bound by any terms (West, 2016). Three Chemistry teachers were given a questionnaire about their interest in STEM-Electrochemistry enrichment book development. It is also obtained from the student's perspective.

The instruments used were semi-structured interview guidelines, media and material expert validation sheets, and student response questionnaire sheets. Chemistry Education lecturers have validated it. Data collection techniques used were questionnaire distribution, which was distributed to get data on the student's and teachers' perceptions about the product and it's development.

The validation results were analyzed and presented in descriptive analysis. It describes the four perspectives. The validation results data were calculated using the Guttman scale, and the response test data were processed using the Likert scale. These data were served in graphical form. It is used to describe a group of data aspects; content, language, presentation, and graphics. The data were analyzed by analyzing graphs, then were related to a simple narrative. The data were presented using the following formula and converted into result percentages.

$$Percentage = \frac{total\ score}{maximum\ score} \times 100\%$$

The final data were concluded the effectiveness of the development of a STEM-based electrochemical enrichment book based on the score interpretation criteria guidelines according to Riduwan & Akdon (2013) in Table 1.

Table 1. Score Interpretation Criteria

No.	Interval Score	Criteria
1.	81 – 100 %	Very good
2.	61 – 80 %	Good
3.	41 – 60 %	Enough
4.	21 – 40 %	Less
5.	0 – 20 %	Very Less

RESULTS AND DISCUSSION

The first stage was the chemistry teacher's interview regarding the learning model used, the need for STEM-based enrichment books, and aspirations for developing STEM-based enrichment books. Then an analysis of the characteristics of students was carried out, which aims to determine students' interest in electrochemistry learning as well as student's interests and needs in STEM-based chemical enrichment books.

Based on the data interviews, teachers and students rarely use enrichment books as secondary materials in the classroom. It causes limited learning time. They also never used a STEM-based chemistry enrichment book because it has yet to be available. Schools need STEM learning socialization, so Chemistry teachers never developed a STEM-based chemistry enrichment book. However, teachers and students consider STEM-based chemistry enrichment books essential to be applied in learning. Teachers are also interested in using STEM-based chemistry enrichment books for learning.

Based on the data analysis of teacher and student interviews, electrochemical concepts were chosen as the material of the enrichment book's development: (1) electrochemistry in textbooks focuses more on balancing redox reactions only; (2) electrochemistry does not prioritize the discussion about electrochemistry' application in daily life at more detail, only general explanation; (3) electrochemistry can be integrated with STEM because the material' discussion includes various technological products that are in accordance with STEM principles, specifically on engineering and technology concepts.

Next, formulating indicators of competency achievement and preparing STEM-based chemical enrichment book indicators was carried out. The determination of electrochemical sub-materials will be included in the enrichment book. The specific indicators were determined from the development of an enrichment book based on the standard of basic competencies and the indicators of competency achievement that have been made; it is hoped that students will achieve this ability.

The STEM-Electrochemistry concept was obtained from teaching materials that were collected from books and journals previously. The teaching materials used as a reference

consist of university books and journals as the main sources, also the factual' and credible' articles as a secondary source.

Ten sub-chapters in electrochemistry would be developed into the main material; zinc-carbon battery, lithium battery, lead-acid battery, silver-oxide battery, nickel-cadmium battery, aluminum-air battery, fuel cell, water electrolysis, electroplating, and electrometallurgy. Each chapter would be integrated with a STEM component, one of the indicators is listed in Table 2.

Table 2. STEM-based chemical enrichment book's indicator

Indicators Learning	Enrichment Book Indicator	Sub-Material	STEM Component
Analyze the symptoms and processes in voltaic cells and electrolytic cells	Analyze symptoms and processes in lithium ion batteries	The principle and how the lithium ion battery works in smartphones	Science
Design of voltaic cells and electrolytic cells	Present the lithium-ion battery manufacture on industrial scale	Lithium ion battery' components and manufacturing process	Engineering
Calculate the measurement in voltaic cells and electrolysis cells	Calculate the measurement that found in the lithium-ion batteries	Calculation of battery capacity, battery SoC and current efficiency	Mathematic
Explain the development and uses of voltaic cells and electrolysis cells in everyday life-day	Describe technological developments on the modified lithium ion batteries	Development of seawater battery, molten salt battery, graphene battery, lithium-CO_2 battery, etc	Technology

Then the design stage continued; the enrichment book format was selected. It involved size and type of paper, paper margins and orientation, font type and font size, the layout of contents, and cover determination. The book was made that refers to the indicators. A validation sheet instrument and student response questionnaire test were also made.

The structure of a STEM-based electrochemical enrichment book includes a beginning section, which consists of the book's identity, introduction, and instruction, also the table of contents. The body section consists of STEM concepts as preliminary material, electrochemical concepts as prerequisite material, and STEM-integrated electrochemistry as core material; the end section includes a glossary, bibliography, and author profile.

The introduction contains a brief explanation of the history of STEM, STEM concepts in general, and the development of the STEM approach in Indonesia. It's also explained redox and electrochemistry as well as the main material. Electrochemical-science aspect contains chemical components, redox reaction equations, workings, chemical principles, and electron flow mechanism until the system can run. Electrochemical-engineering aspects include materials, tools, and product manufacturing processes, the work function of product components, and the composition of substances used in electrochemical cell products. The

following is an example of a book description; Electrochemical-science and Electrochemical-engineering aspects in the book are listed in Figure 1 and Figure 2.

Figure 1. STEM components–science

Figure 2. STEM components–engineering

Electrochemisty-mathematical aspects include calculations related to electrochemical cell products. It also described various tests to measure the quality of electrochemical cells produced. Electrochemistry-technological aspect refers to an electrochemical cell' product that undergoes modifications to its components; anode, cathode, etc., the product's usability and

efficiency, dis/advantages also the production scale level of the modified products. There is also secondary content sourced from the chosen articles. It supports thinking skills and strengthens students' comprehension; not used as an evaluation tool. Electrochemistry-mathematical aspect and Electrochemistry-technological aspect are listed in Figure 3 and Figure 4.

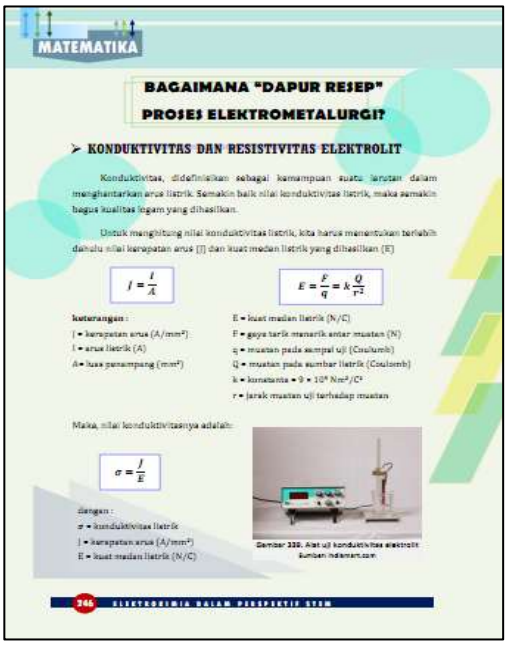

Figure 3. STEM components–mathematics

Figure 4. STEM components–technology

The enrichment book product was then corrected by the 1st, 2nd, 3rd, 4th and 5th validators as the media expert validator consists of chemistry teachers and lecturers. The

aspects of eligibility guided the validation: content, presentation, language, and graphics (Yustinah et al., 2019). After the first validation was completed, it was continued with the revision of the enrichment book. After the book revision was completed, the validator continued the second validation. The validation results of a STEM-based electrochemistry enrichment book are listed in Table 3.

Table 3. Validation result data

No.	Aspect	Average Percentage (%)		Aspect Average (%)	Category
		Validation-1 (%)	Validation-2 (%)		
1.	Content	97	100	98,5	Very Good
2.	Presentation	75	100	87,5	Very Good
3.	Language	100	100	100	Very Good
4.	Graphic	100	100	100	Very Good

The suggestions obtained from the validation results are used as a reference to improve the enrichment book. There is the revision of the enrichment book includes the addition of content; addition of the text and illustrations; changes the font size and model; changes in shape, color, and composition of image illustrations; writing sources and descriptions of images, foreign words, formulas also process flow chemistry; changes of layout and spacing between paragraphs, punctuation, and also other writing errors.

The last sub-stage was a limited field trial, which was conducted on 37 students at one of the senior high schools in Indonesia. The trial is intended as a result of a STEM-based chemical enrichment book' feasibility evaluation. The trial was carried out by filling out a response questionnaire after the students read the book. The results of the response questionnaire recapitulation are listed in Figure 3.

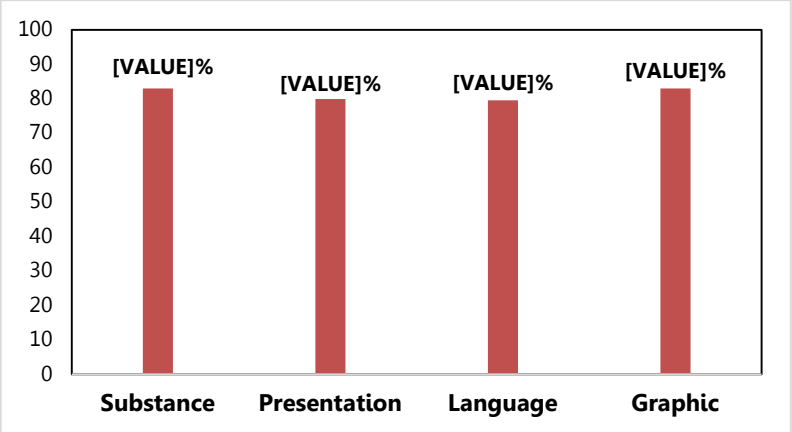

Figure 3. Average percentage of each aspect

Based on Table 3, it can be seen that the average percentage of the questionnaire for each aspect of the students shows the following results. The content aspect meets the appropriate criteria with a moderate aspect acquisition of 82.97% with a very good predicate.

Most students thought the electrochemical material presented was complete and compatible between STEM concepts and electrochemical material. This follows Yustinah et al.' theory (2019) that the advantages of enrichment books are that they have complete and broad content and focus on a topic that students need only. Some students also think that the electrochemical concept is suitable for reality. This agreed with Asrizal et al. (2020), which stated that enrichment books must present factual information.

Electrochemistry-STEM enrichment book is also in line with Rinjani's statement (2019) that enrichment books are intended as a complement to textbooks, and that content needs to be presented critically and creatively to improve students' thinking skills (Noorhapizah et Al., 2020).

The graphic aspect obtained an average score percentage of 82.92% in a very good category. This indicates that the enrichment book has good graphic elements, including the size and type font and layout and spacing per paragraph applied. This follows Hojjati & Muniandy (2014) say that using typography and paragraph placement affects reading clarity in enrichment book.

The enrichment book also has compatibility in the placement and coloring of the layout. This agrees with Došen & Brkljačić' theory (2018) that shape, size, color, and other illustration placement must follow the original object to prevent misinterpretation. The enrichment book's illustrations, color and layout also support the student's literacy (Brookshire, 2002).

The presentation aspect gets an average percentage of 79.90% in good criteria. The results of student responses showed that some indicators, such as the application of examples and material activities, the material concept, and the interest in visual content, were in a good category.

This follows Rinjani's research (2019); an enrichment book should contain examples, questions, and enrichment activities related to the material presented so the students can understand it well. The enrichment book should contain the principle of coherence between sentences, paragraphs, and context so it becomes logical to read (Suwandi, 2016).

Enrichment books must also describe exercises and exciting illustrations to motivate students to read the other enrichment books. Moreover, the materials and examples that are included should be related to everyday life and can be applied by students independently (Thummathong & Thathong, 2018).

The aspect of language obtained from the results of the student response test of 79.56% in the good category. This shows that the STEM-electrochemical enrichment book has a proper language. It's in line with Vorenberg's theory (2017) that the language applied in the

enrichment book must be straightforward to help the students understand the author's writing. This is also reinforced by Putra & Triyono's (2018) statement, which explains that applying Indonesian language spelling correctly can convey information properly.

This STEM-electrochemical enrichment book also fulfills the principle of student language development. It was explained by Biçera & Batdıb (2019) that it must be under the students' language skills to avoid miscommunication.

According to Riduwan & Akdon (2013), If the percentage score from the result of student responses is in the value range of 81 – 100, it's included in the very good category. Based on the student response test results, an average percentage of 81.34% was obtained. It can be concluded that the development of a STEM-based on electrochemical enrichment book is included in the very good category.

A STEM-based electrochemical enrichment book can be one of the initial contributions to developing STEM education in Indonesia, especially for reference materials needs. It can be used as an initial step to the next STEM enrichment book development, especially in chemistry or another study. This book can be used as teaching material or a secondary textbook for schools that already have to implement STEM education. It supports the implementation of STEM education in schools in Indonesia.

CONCLUSION

This research has produced a STEM-based chemical enrichment book on electrochemical material, which was developed through the 4D research stages of Thiagarajan, Semmel & Semmel (1974). The process of making an enrichment book has been carried out and continued with validation by material & media experts with an average percentage of the validation results of each eligibilities aspects; content of 98.5%, presentation of 87.5%, language and graphics each has a value of 100%. Next, a limited trial process for students was carried out, with the average percentage of the response test results of each aspect: the content at 82.97%, presentation at 79.90%, language at 79,56%, and graphics at 82.92%. Overall, the STEM-based electrochemical enrichment book obtained 81.34%, including the proper category with a very good predicate. The STEM-integrated electrochemistry enrichment book can be used as a secondary textbook for chemistry learning.

REFERENCES

Asrizal, Desnita, and Yenni Darvina. (2020). Need analysis to develop electronic enrichment book of Physics based on contextual teaching and environmental potential. *The 2nd International Conference on Research and Learning of Physics*. https://doi:10.1088/1742-6596/1481/1/012123.

Biçera, Nurşat & Veli Batdıb. (2019). An investigation of textbooks used to teach Turkish as a foreign language with Rasch measurement model and Maxqda. *Journal of Language and Linguistic Studies*, 15(4), 1269-1286.

Brookshire, J., Scharff, L. & Moses, L. (2002). The influence of illustrations on children's book preferences and comprehension Reading Psychology, Vol 23(4), 323 - 339. https://doi:10.1080/713775287.

Creswell, John. W. (2009). *Research Design: Quantitative, Qualitative and Mixed Method Approaches*. California : SAGE Publications, Inc.

Došen, Đurđana Ozretić & Lidija Brkljačić. (2018). Key design elements of daily newspapers: Impact on the reader's perception and visual impression. *KOME − An International Journal of Pure Communication Inquiry*, 1-19. https://doi: 10.17646/KOME.75692.93.

Fikri, M. R., Muslim, Purwana, U., & Karyawan. (2019). Upaya Meningkatkan Kreativitas Siswa Dalam Membuat Karya Fisika Melalui Model Pembelajaran Berbasis STEM (*Science, Technology, Engineering and Mathematic*) pada Materi Fluida Statis. *Jurnal Wahana Pendidikan Fisika*, 4(1), 73-76. https://doi.org/10.17509/wapfi.v4i1.15771.

Giani, Zulkardi, & Hiltrimartin, C. (2015). Analisis Tingkat Kognitif Soal - Soal Buku Teks Matematika Kelas VII Berdasarkan Taksonomi Bloom. *Jurnal Pendidikan Matematika*, 9(2), 1-20. http://dx.doi.org/10.22342/jpm.9.2.2125.78 - 98.

Hojjati, Nafiseh & Balakrishnan Muniandy. (2014). The Effects of Font Type and Spacing of Text for Online Readability and Performance. *Contemporary Educational Technology* 5(2), 161-174.

Kamsi, Nor Samsinar, R B Radin Firdaus, Farrah Dina Abdul Razak & M Ridha Siregar. (2019). Realizing Industry 4.0 Through STEM Education: But Why STEM Is Not Preferred?. *1st South Aceh International Conference on Engineering and Technology*, 1-7. https://doi:10.1088/1757-899X/506/1/012005.

Kurniawati, Mei Wulan, Sri Anitah & S. Suharno. (2017). Developing Learning Science Teaching Materials Based on Scientific to Improve Students Learning Outcomes in Elementary School. *European Journal of Education Studies*, 3(4), 319-330. https://doi: 10.5281/zenodo.398991.

Mainier, Fernando B., Luciane P. C. Monteiro, Antonio Carlos M. Rocha, Renata J. Mainier. (2013). Industrial electrochemical: a new teaching approach. *American Journal of Engineering Research (AJER)*, 2(8), 58-64. e-ISSN : 2320-0847, p-ISSN : 2320-0936.

Marius, Parlindungan & Freddie Pinontoan. (2013). *Indonesia Internet Usage For Bussiness Sector 2013*. Jakarta: Asosiasi Penyelenggara Jasa Internet Indonesia (APJII). https://apjii.or.id/downfile/file/SurveiPenggunaanInternetSektorBisnis2013versienglish.pdf [Accessed on May 10, 2022].

Mathis, Corey A., Emilie A. Siverling, Tamara J. Moore, Kerrie A. Douglas, S. Selcen Guzey. (2018). Supporting Engineering Design Ideas with Science and Mathematics: A Case Study of Middle School Life Science Students. *International Journal of Education in Mathematics, Science and Technology (IJEMST),* 6(4), 424-442. https://doi:10.18404/ijemst.440343.

Ministry of Education. (2008). *Peraturan Menteri Pendidikan Nasional Nomor 2 Tahun 2008 Tentang Buku.* Jakarta: Kemendiknas.

Ministry of Education. (2014). *Konsep dan Implementasi Kurikulum 2013*. https://www.kemdikbud.go.id [Accessed on March 17, 2022].

Ministry of Education. (2016). *Hasil Indonesian National Assesment Programme (INAP)*. pusmenjar.kemdikbud.go.id/inap-sd/ [Accessed on March 17, 2022].

Ministry of Education. (2018). *Panduan Pemilihan Buku Nonteks Pelajaran.* Jakarta: Pusat Kurikulum dan Perbukuan Kemendikbud.

Noorhapizah, Akhmad Riandy Agusta & Diani Ayu Pratiwi. (2020). Learning Material Development Containing Critical Thinking and Creative Thinking Skills Based on Local Wisdom. *Proceedings of the 6th International Conference on Education and Technology (ICET)*: Advances in Social Science, Education and Humanities Research, 501, 43-57. https://doiI:10.2991/assehr.k.201204.007.

OECD. (2019). PISA 2018 Results: Combined Executive Summaries Volume I, II & III. https://www.oecd.org/pisa/Combined_Executive_Summaries_PISA_2018.pdf [Accessed on March 17, 2022].

Purnawirawan, Okta, I Made Sudana & Muhammad Harlanu. (2019). Assessment of 4C Softskills Characteristics in Learning Productive Graphic Design Subject for Vocational School. *Journal of Vocational Career Education (JVCE),* 4(1), 53-60. https://doi: 10.15294/jvce.v4i1.21867.

Putra, Rizky Anugrah & Sulis Triyono. (2018). Outlandish Spelling System Invented by Indonesian Internet Society: The Case of Language Usage in Social Networking Site. *International Journal of Applied Linguistics & English Literature*, 7(7), 66-73. https://doi:10.7575/aiac.ijalel.v.7n.7p.66.

Riduwan & Akdon. (2013). *Rumus dan Data Dalam Analisis Statistika.* Bandung: Alfabeta.

Rinjani, Ersila Devy. (2019) Enrichment Book of Writing Narration Based on CLIL and Character Building. *Proceedings of the 3rd Annual International Seminar and Conference on Global Issues (ISCoGI 2017),* 140, 99-103. https://doi:10.2991/iscogi-17.2019.23.

Sima, Violeta, Ileana Georgiana Gheorghe, Jonel Subić & Dumitru Nancu. (2020). Influences of the Industry 4.0 Revolution on the Human Capital Development and Consumer Behavior: A Systematic Review. *Sustainability,* 12(10), 4035. https://doi.org/10.3390/su12104035.

Suryaningsih, Siti, Fakhira Ainun Nisa, Buchori Muslim & Fauzan Aldiansyah. (2021). Learning Innovations: Students' Interest and Motivation on STEAM-PjBL. *International Journal of STEM Education for Sustainability*, 2(1), 66-77. http://dx.doi.org/10.52889/ijses.v2i1.40.

Sutaphan, Sukanya & Chokchai Yuenyong. (2019). STEM Education Teaching approach: Inquiry from the Context Based. *Journal of Physics: International Annual Meeting on STEM Education (I AM STEM)* 2018, 1340(1), 1-18. https://doi:10.1088/1742-6596/1340/1/012003

Suwandi. (2016). Coherence and Cohesion: An Analysis of The Final Project Abstracts of The Undergraduate Students of PGRI Semarang. *Indonesian Journal of Applied Linguistics*, 5(2), 253-261. https://dx.doi.org/10.17509/ijal.v5i2.1349.

Thummathong, Rungrat & Kongsak Thathong. (2018). Chemical literacy levels of engineering students in Northeastern Thailand. *Kasetsart Journal of Social Sciences*, 1-10. https://doi:10.1016/j.kjss.2018.06.009.

Tunc, Cevdet & Birsen Bagceci. (2021). Teachers' Views of the Implementation of STEM Approach in Secondary Schools and The Effects on Students. *Pedagogical Research*, 6(1), e-ISSN: 2468-4929. https://doi.org/10.29333/pr/9295.

Vorenberg, Amy. (2017). Strategies and Techniques for Teaching Legal Analysis and Writing. England: ASPEN Publishing.

Vrchota, Jaroslav, Monika Maˇriková, Petr Rehoˇr, Ladislav Rolˇínek and Radek Toušek. (2020). Human Resources Readiness for Industry 4.0. *Journal of Open Innovation: Technology, Market, and Complexity,* 6(3). https://doi:10.3390/joitmc6010003.

West, P. W. (2016). Simple random sampling of individual items in the absence of a sampling frame that lists the individuals. *New Zealand Journal of Forestry Science*, 46(15), 1-7. https://doi:10.1186/s40490-016-0071-1.

Yustinah, Fathur Rokhman, Subyantoro & Ida Zulaeha. (2019). The Development of Supplementary Books Producing Explanatory Text and Procedure Text With Entrepreneurial Content For Vocational School Student. *Proceedings of the 5th International Conference on Science, Education and Technology, ISET 2019*. https://doi:10.4108/eai/29-6-2019.2290469.

Zilberman, Alan & Lindsey Ice. (2021). Why computer occupations are behind strong STEM employment growth in the 2019–29 decade [Article]. 10(1). https://www.bls.gov/opub/btn/volume-10/why-computer-occupations-are-behind-strong-stem-employment-growth.htm [Accessed on May 10, 2022].