

Creating An Environmentally Literacy Oriented E-Magazine on Household Waste Materials

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Abstract

This study aims to describe the appearance, analysis of the results of the validation test and the analysis of the results of the feasibility test of e-magazine environmental literacy oriented on the topic household waste. This study uses the DBR (Design Based Research) method through the preliminary stages (analysis and deepening of the material), design (initial product manufacture), and development (validation test and feasibility test product). The resulting product is an e-magazine environmental literacy oriented on household waste material entitled "Household Waste Management". The validation test was carried out by three validators consisting of material expert lecturers and media experts. The average value of rcount of the validation test results for material, language and media display aspects is 0.87; 0.78; 0.89 which indicates that the e-magazine made is valid. Furthermore, a feasibility test was carried out on 20 students consisting of 10 students of chemistry education who were taking courses in waste management and treatment and 10 students outside of chemistry education who were randomly selected. The average value of the feasibility test results from the aspect of material, language and media display respectively is 97.00%, 97.50%; 95.00%. This shows that the e-magazine environmental literacy oriented on the topic household waste that is made is declared very feasible to be used as a learning medium.

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Introduction

Waste is an environmental problem that causes many negative impacts on life and can damage beauty. The increasing population will affect the amount of waste produced, one of which is household waste (Sunarsih et al., 2014). If waste is not managed properly, it will certainly have negative impacts, including environmental pollution and health problems. However, if this waste can be managed well, it will provide benefits in terms of the environment, health and economy (Sari et al., 2018).

Currently, public awareness of protecting and preserving the environment is still relatively low. Many of them do not understand how to manage and utilize the waste produced (Hasibuan, 2016). Attitudes and behavior to protect and preserve the environment must be instilled in the community as early as possible to prevent environmental pollution (Wahyuningsih & Rohmah, 2017). Education is the right means to provide education about awareness of the importance of protecting and preserving the environment (Hasibuan, 2016). Environmental literacy-oriented learning, especially in subjects that are closely related to life and the environment, is deemed necessary to be applied to teaching materials (Saribas et al., 2014). In the era of globalization, technological developments are very rapid, bringing changes in aspects of life, including education (Hasian Floren et al., 2020).

Of course, this technological development must be utilized, one of which is the application of Android-based teaching materials so that they can display material that is interesting and easily accessible to students via electronic devices (Rahayu, 2018).

One of the Android-based learning media or teaching materials is an electronic magazine (e-magazine). Using e-magazines as a learning medium, students can access learning flexibly, anytime and anywhere via smartphone or laptop (Jung & Zhou, 2019). E-magazines can be an effective learning media that can increase students' interest and motivation in learning, because e-magazines are equipped with packaging of learning materials in the form of pictures, animations and videos which make the material more interesting and can support the content of the material in more dept (Muhammad & Daniel, 2018). Apart from that, e-magazines can help users learn more efficiently (Ziden & Khalid, 2014). So, with this feature, it is hoped that it can improve the quality of student learning and increase students' environmental literacy.

Learning media in the form of e-magazines have been developed before, including research by Palennari et al. (2019) which states that the use of flipcreator-based e-magazines has been proven to help make it easier for students to understand lessons. Then research by Srikandi et al. (2020) stated that the use of e-magazines is suitable for use as a learning medium, proven by an increase in students' interest in learning by 7.30%. Furthermore, research conducted by Jariati & Yenti (2020) stated that learning media in the form of electronic magazines are very popular with students. It is proven that learning media in the form of e-magazines is one of the effective learning media used during learning

to help increase environmental literacy in students. Learning media in the form of e-magazines have been developed before, including research by Palennari et al. (2019) which states that the use of flipcreator-based e-magazines has been proven to help make it easier for students to understand lessons. Then research by Srikandi et al. (2020) stated that the use of e-magazines is suitable for use as a learning medium, proven by an increase in students' interest in learning by 7.30%. Furthermore, research conducted by Jariati & Yenti (2020) stated that learning media in the form of electronic magazines are very popular with students. It is proven that learning media in the form of e-magazines is one of the effective learning media used during learning to help increase environmental literacy in students.

Based on the description that has been presented, the innovation in this research is to create interesting chemistry teaching materials in the form of an e-magazine by highlighting environmental literacy-oriented household waste material that focuses on the management and processing of solid waste or household waste by collecting appropriate references, then packaged in one platform, namely in the form of an electronic magazine or e-magazine. The e-magazine contains several rubrics, each of which contains sub-themes from the e-magazine which contains the contents of the discussion in the e-magazine which can make it easier for readers to study it. The discussion of this e-magazine consists of five rubrics which include; problems and impacts of household waste, household waste management regulations, types of household waste, principles of household waste management, and household waste processing. Apart from that, this e-magazine presents material that is integrated with Islamic values so that it is hoped that it can increase the body of knowledge while increasing the spirituality of readers. This e-magazine learning media will be packaged with a visual design equipped with images and videos, using interactive and persuasive words so that it is more interesting to read, and can be accessed online to be used as an effective independent learning resource.

The aim of this research is to describe the appearance, validation test results and feasibility test results of an environmental literacy-oriented e-magazine on household waste material. Through this research, it is hoped that it will become a useful, effective and very environmentally friendly learning media, as a concrete contribution in the field of education and community empowerment in an effort to increase environmental literacy, especially regarding household waste.

Research Method

This research was conducted using the DBR (Design Based Research) method. The DBR method is a design-based research method that is based on technology and has two stages, namely analysis and design development (Herrington, 2007). The development procedure in this research adapted the 4-D model (four-D model). According to Thiagarajan and Semmel, product development includes the define (preliminary), design (design), development (development) and disseminate (dissemination) stages (Taruh & Mursalin, 2018). However, in this research it only reached the development stage.

The define (preliminary) stage aims to determine and define needs in the learning process and collect various information related to the product to be developed. The steps taken are to create a concept analysis, concept map, discourse analysis, flowchart and storyboard. The design stage aims to design the e-magazine that will be developed. This stage includes media selection, format selection, reference collection, instrument creation, and initial design creation. Then the development stage aims to produce an e-magazine that has been revised based on input from the validator.

The types of data in this research are qualitative and quantitative. Qualitative data was obtained from descriptions of e-magazine product displays based on research instruments such as flowcharts and storyboards. Then quantitative data is obtained from validation test questionnaires and product feasibility tests, based on the values given by validators and respondents to the criteria presented. The types of data in this research are qualitative and quantitative. Qualitative data was obtained from descriptions of e-magazine product displays based on research instruments such as flowcharts and storyboards. Then quantitative data is obtained from validation test questionnaires and product feasibility tests, based on the values given by validators and respondents to the criteria presented.

Research data sources consist of primary and secondary data sources. Primary data was obtained based on validation test results and feasibility test results. The validation test was carried out by three validators who were material expert lecturers and learning media expert lecturers. Meanwhile, the feasibility test was conducted on 20 respondents, namely 10 chemistry education students and 10 students outside chemistry education who were chosen randomly.

The data collection technique starts from the data analysis stage in the form of collecting teaching materials that will be displayed in the e-magazine, then the design stage of making the e-magazine. Next, the e-magazine that has been created is subjected to a validation test with the validator. After receiving improvements, a feasibility test was then carried out on 20 respondents by attaching an e-magazine link that could be accessed online and an explanatory video and e-magazine that had been created.

Qualitative data analysis was carried out by describing the stages of creation, content and appearance of the e-magazine product created, as well as improvements made based on criticism and suggestions from validators and respondents in

the feasibility test. Quantitative data analysis was carried out by analyzing the validation test results using a Likert scale, then processing it to determine validity (calculated r value) and then comparing it with the set critical value of 0.30. The following is the formula for finding the feasibility value (r):

$$r = \frac{x}{N \cdot n}$$

Information:

- r = Feasibility value
- x = Respondent's answer weight
- N = Number of items
- n = Number of respondents

If the value of each criterion item is <0.3 then the criterion item is declared valid. Conversely, if the r value of the criterion item is > 0.3 then the criterion item is declared invalid (Achat-mendes et al., 2019). The feasibility value (rcount) can be seen in Table 1 (Sugiyono, 2018).

Table 1. Interpretation of Feasibility Values

No	Mark	Predicate
1.	0 – 49	Very less
2.	50 – 59	Not enough
3.	60 – 69	Enough
4.	70 – 79	Good
5.	80 – 100	Very good

The final stage is calculating the overall feasibility percentage of the product in the form of an e-magazine to determine the suitability of the product as a learning medium. Data from the feasibility test were analyzed using the Guttman scale to calculate the feasibility percentage using the following equation:

$$\% \text{ Feasibility} = \frac{\sum n}{N} \times 100\%$$

Information: $\sum n$ = total weight of respondents' answers, N = total number of respondents

The results of the data processing will be analyzed and used as a tool to determine the suitability of the product that has been made. Interpretation of the feasibility of the products that have been made can be seen in Table 2 (Subana & Rahadi, 2015).

Table 1. Interpretation of the Feasibility of Teaching Materials

No	Percentage (%)	Qualification
1.	90 – 100	Very worthy
2.	80 – 89	Worthy
3.	70 - 79	Decent enough
4.	60 – 69	Not worth it
5.	< 60	Not really worth it

Results and discussions

Environmental Literacy Oriented E-magazine Display on Household Waste Materials

The environmental literacy-oriented e-magazine display on household waste material was created to produce the final product of e-magazine learning media entitled "Household Waste Management" in the form of a website link that can be accessed online via electronic devices and consists of 73 pages. The content presented in the e-magazine contains material on household waste, especially solid waste or household waste, which discusses five main topics, namely the problems and impacts of household waste, Household waste management regulations, types of Household waste, principles of waste management. Household, and Household waste processing. The following displays the cover, table of contents, and one of the initial sections of the topic in the e-magazine:

The household waste material in the e-magazine contains environmental literacy components consisting of aspects of knowledge, cognitive skills, attitudes and actions towards the environment. Each section of the e-magazine is adapted to aspects of environmental literacy so that readers are able to discover concepts and improve aspects of environmental literacy. The Figure 3 and 4 is one of the displays of an e-magazine which contains aspects of environmental literacy.

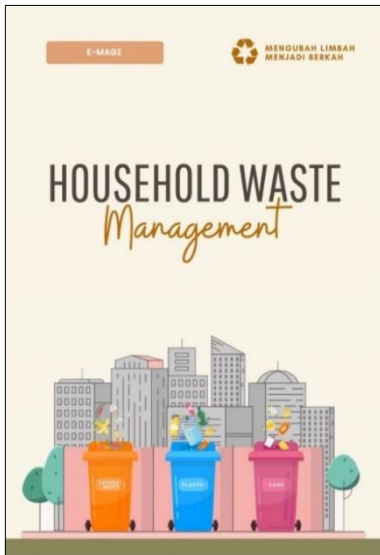


Figure 1. Front cover meter

DAFTAR ISI
#householdwastemanagement

PENGANTAR Hikmah QS. Ar-Rum: 41	1	PRINSIP PENGELOLAAN	33
PERMASALAHAN & DAMPAK SAMPAH RT Permasalahan Sampah Komposisi Sampah Tragedi Ledakan Sampah Pencemaran Akibat Sampah Hikmah QS. Al-a'raf: 55	2 3 4 6 9 12	SAMPAH RT Memilah Sampah Konsep 3 AH Zero Waste Food Wastage	35 36 39 43
REGULASI SAMPAH RT	20	PENGOLAHAN SAMPAH RT Eco-Enzyme Kompos Daur Ulang Kerajinan Ecobrick	47 48 52 60 62 63
JENIS SAMPAH RT Pengertian Sampah RT Sampah Organik Sampah Anorganik Sampah B3	25 26 26 27 28	DAFTAR PUSTAKA PROFIL PENULIS	68 69

Figure 2. Table of content display



Figure 1. Initial view of the topic

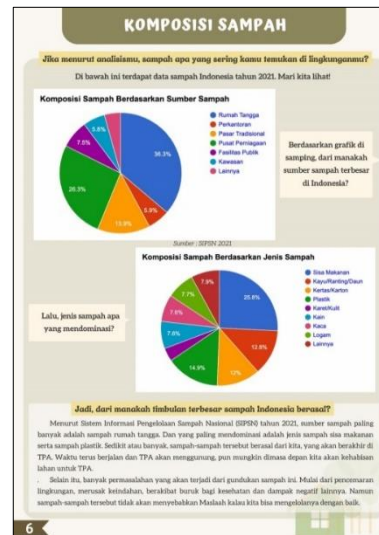


Figure 4. Display that contains aspects of knowledge



Figure 5. Display that contains aspects of action towards the environment



Figure 6. Display that contains aspects of attitudes and cognitive skills

Apart from being oriented towards environmental literacy, the e-magazine that was created also presents material that is integrated with Islamic values so that it is hoped that it can increase the body of knowledge while increasing the spirituality of readers. This can be seen in Figure 7. The content in each material in the e-magazine rubric is presented in the form of text, images, graphics, tables, dialogues and videos which are packaged using interactive and persuasive words so that they are more interesting to read. According to (Gilbert et al., 2018) it is necessary to use images, videos, tables, graphs in transferring knowledge in order to understand chemical phenomena easily. So, by maximizing the use of visualization in e-magazines, it will be easier for writers to convey information and direct readers to the concepts presented (Thomas et al., 2018). This display can be seen in Figure 8 and 9.

After all the e-magazine content is created, the e-magazine design is then saved in PDF format. After that, the file is converted into 3D by embedding the PDF file into an HTML page with the Flipbook Corporation application, so that the e-magazine has a back-and-forth display and contains audio and video features and can be accessed online via electronic devices. This process resulted in an initial product in the form of an e-magazine link with an environmental literacy orientation on household waste material that was ready to be validated. The final appearance of the environmental literacy-oriented e-magazine can be seen in Figure 9.



Figure 7. Treasure view



Figure 8. Display that contains images, graphics and videos

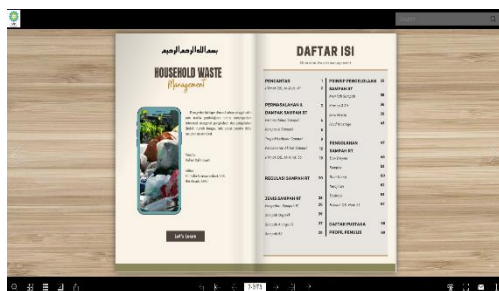


Figure 9. Appearance of the front cover and contents of the e-magazine

Environmental Literacy Oriented E-Magazine Validation Test Results on Household Waste Materials

After the initial product has been created, validation tests are carried out. At this stage, a validation test of the initial environmental literacy-oriented e-magazine product was carried out on household waste materials by three validators, namely material expert lecturers and learning media experts. The function of this validation is to check the initial quality of the e-magazine product that has been created. This is in accordance with the opinion of Kerres & Bedenlier (2016) that the purpose of the validation process is to test the validity of the product that has been created.

At the validation stage, the assessment criteria are aspects of material content, language aspects and appearance aspects. This aims to enable researchers to know more specifically the shortcomings of each aspect, so that the improvement process is easier. The validation process is carried out offline and online by providing an assessment questionnaire to the validator to fill out after seeing the initial product as a whole. The average r-calculation results for each aspect of the environmental literacy-oriented e-magazine on household waste material can be seen in Table 1.

Table 1. Average r_{count} Validation Test

No.	Rated aspect	r_{count}	r_{critical}	Results
1.	Material aspect	0,87	0,3	Valid
2.	Language aspect	0,78	0,3	Valid
3.	Display aspect	0,89	0,3	Valid

In general, the results of the validation show an average value of more than 0.3 for each aspect, so that environmental literacy-oriented e-magazine products on household waste materials can be declared valid. This is in accordance with the statement of Sugiono (2013) which states that if the r value is more than 0.3 then the criteria item is declared valid. Conversely, if the calculated r value is smaller than 0.3 then the criterion item is declared invalid.

Feasibility Test Results for Environmental Literacy-Oriented E-Magazines on Household Waste Materials

After the product is declared valid from various aspects, a feasibility test is then carried out. At this stage, product feasibility testing is carried out on a small scale on respondents selected based on considerations (purposive sampling). Respondents consisted of 20 people, namely 10 chemistry education students who had taken courses in waste management and processing courses and 10 students outside chemistry education who were chosen randomly. The purpose of the feasibility test for chemistry education students is to determine the feasibility of an environmental literacy-oriented e-magazine on household waste material that has been created as a learning medium or learning resource in chemistry education. The purpose of the feasibility test for students outside the chemistry education study program is to determine the feasibility of an e-magazine created so that it can be used as a learning resource for the general public.

The feasibility test is carried out by providing a feasibility test questionnaire by attaching an e-magazine link that can be accessed online and an explanatory video and e-magazine created to respondents with the aim of obtaining responses in the form of assessments and suggestions for improvement, including aspects of the presentation of material content, language and appearance.

In full, the average percentage of each aspect of the environmental literacy-oriented e-magazine on household waste material can be seen in the Table 2.

Table 2. The average percentage of each aspect of the environmental literacy-oriented e-magazine on household waste material

No.	Rated aspect	Average percentage	Interpretation
1.	Material aspect	97,00%	Very worthy
2.	Language aspect	97,50%	Very worthy
3.	Display aspect	95,00%	Very worthy
Total Percentage Average		96,50%	Very worthy

The overall feasibility test results have an average percentage of 96.50%. So, the environmental literacy-oriented e-magazine on household waste material is included in the very appropriate category from the aspect of appearance, so that the e-magazine is ready to be used as a learning medium to support chemistry learning and for society in general.

Based on the results of the validation and feasibility tests, the environmental literacy-oriented e-magazine on household waste material created is valid and very suitable for use as a chemistry learning medium or learning resource for the general public, with the aim of every reader being able to manage and process household waste. in everyday life so as to increase environmental literacy. However, further development can be carried out to perfect and correct the shortcomings of the e-magazine created to then be applied in the environmental chemistry learning process for students and the community.

Conclusion

The appearance of the e-magazine consists of the front cover, e-magazine description, introduction, 5 e-magazine rubrics (problems and impacts of household waste, household waste regulations, types of household waste, principles of household waste management, and household waste processing), bibliography, author profile, and back cover. The appearance of the e-magazine is packaged with a visual design equipped with images and videos, using interactive and persuasive words, so that it is more interesting to read and can be accessed online so that it can be used as an effective independent learning resource. The results of the environmental literacy-oriented e-magazine validation test on household waste material have an average value of 0.87 for the material, language and media appearance aspects, respectively; 0.78; 0.89. Based on these results, the e-magazine oriented towards environmental literacy on household waste material that was created was declared valid, because the calculated r value was greater than the critical value, namely 0.3. The results of the environmental literacy-oriented e-magazine feasibility test on household waste material in the material presentation aspect obtained a percentage of 97.00%, in the language aspect the percentage obtained was 97.50% and in the appearance aspect the percentage obtained was 95.00%. So, it can be seen that the e-magazine

oriented towards environmental literacy based on household waste material has been declared very suitable for use as a learning medium.

References

- Ghazali, I. (2018). *Pengembangan Media Pembelajaran Majalah Elektronik Menggunakan 3D Pageflip Professional Materi Reaksi Redoks Untuk Siswa Kelas X SMA Dharma Bhakti 4 Kota Jambi*. [Skripsi]. Universitas Jambi.
- Gilbert, T., Kirss, R., Foster, N., & Bretz, S. (2018). Chemistry-The Science in Context. In G. Davies (Ed.), *Acta Biológica Paranaense* (fifth, Vol. 38). w.w. Norton & Company. <https://doi.org/10.5380/abpr.v38i0.16412>
- Hasian F., S., Yusnaidar, Y., & Syahri, W. (2020). Pengembangan Majalah Kimia Elektronik Berbasis Metakognisi Pada Materi Hukum-Hukum Dasar Kimia Untuk Siswa Kelas X MIPA SMAN 3 Kota Jambi.
- Hasibuan, R. (2016). Analisis Dampak Limbah/Sampah Rumah Tangga Terhadap Pencemaran Lingkungan Hidup. *Jurnal Ilmiah Advokasi*, 4(1), 42–52. <http://jurnal.ulb.ac.id/index.php/advokasi/article/view/354>
- Herrington. (2007). *Design Based Research and doctoral students: guidelines for preparing a dissertation proposal*. Edith Coan University.
- Husna, A., Syahri, W., & Zurweni, Z. (2021). *Pengembangan Majalah Kimia Elektronik Menggunakan 3d Pageflip Pada Materi Korosi Kelas XII SMA Negeri 2 Bungo*. Universitas Jambi.
- Jariati, E., & Yenti, E. (2020). Pengembangan E-Magazine Berbasis Multipel Representasi untuk Pembelajaran Kimia di SMA pada Materi Larutan Elektrolit dan Non Elektrolit. *Journal of Natural Science and Integration*, 3(2), 138. <https://doi.org/10.24014/jnsi.v3i2.10131>
- Jung, H., & Zhou, Q. (2019). Learning and Sharing Creative Skills with Short Videos: A Case Study of User Behavior in TikTok and Bilibili. *International Association of Societies of Design Research Conference*, 10, 25–50.
- Kerres, M., & Bedenlier, S. (2016). *Systematic Reviews in Educational Research*. Springer Berlin Heidelberg.
- Nengsih, A. N. (2020). *Pengembangan Media Pembelajaran E-Magazine Pada Materi Peran Kimia Dalam Kehidupan Kelas X IPA di SMAN 5 Batanghari*. Universitas Jambi.
- Nisa Muhammad, N., & Danial, M. (2018). *Pengembangan Bahan Ajar Majalah Elektronik Fungsi untuk SMA Kelas X*. Development of Teaching Materials Fungsi Electronic Magazine for Senior High School Grade X.
- Palennari, M., Wiharto, M., Biologi, J., & Matematika dan Ilmu Pengetahuan Alam, F. (2019). Pembelajaran Metabolisme dengan menggunakan majalah elektronik berbasis flipcreator Learning Metabolism by using electronic magazines flipcreator based. *In Seminar Nasional Biologi* (Vol. 0, Issue 0). <http://103.76.50.195/semnasbio/article/view/10616>
- Rahayu, S. (2018). Promoting the 21 st century scientific literacy skills through innovative chemistry instruction Promoting the 21 st Century Scientific Literacy Skills through Innovative Chemistry Instruction. *AIP Conference Proceeding*, 02(December 2017), 1–8.
- Rezeki, S. (2020). *Pengembangan E-Magazine Berbasis Metakognisi Pada Materi Ikatan Kimia Kelas X IPA Di SMAN 8 Bungo*. Universitas Jambi.
- Sari, S. A., Kembaren, A., & Sudrajat, A. (2018). The Development of Handout Based on Guided Note Taking to Improve the Quality of Analytical Chemistry Learning. *International Journal of Social Sciences*, 4(3), 720–734.
- Saribas, D., Teksoz, G., & Ertepinar, H. (2014). The Relationship between Environmental Literacy and Self-efficacy Beliefs toward Environmental Education. *Procedia - Social and Behavioral Sciences*, 116(2), 3664–3668.
- Srikandi, N., Putra, I. A., & Pertiwi, N. A. S. (2020). Majalah Elektronik Materi Rambatan Kalor untuk Meningkatkan Minat Belajar Peserta Didik. *DIFFRACTION*, 2(1), 1–8. <https://doi.org/10.37058/diffraction.v2i1.1309>
- Subana, & Rahadi, M. S. (2015). *Statistik Pendidikan*. Pustaka Setia.
- Sugiyono. (2013). *Metodelogi Penelitian Kuantitatif Kualitatif dan R&D*. CV. Alfabeta. Bandung.
- Sugiyono. (2018). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D* (CV (ed.)). Alfabeta. Bandung.
- Sunarsih, E., Pengajar, S., & Kesehatan, F. (2014). Konsep Pengolahan Limbah Rumah Tangga Dalam Upaya Pencegahan Pencemaran Lingkungan Concept of Household Waste in Environmental Pollution Prevention Efforts. *In Jurnal Ilmu Kesehatan Masyarakat* (Vol. 5, Issue 3). <http://ejournal.fkm.unsri.ac.id/index.php/jikm/article/view/158>
- Taruh, E., & Mursalin. (2018). Development of Authentic Assesment Tools in Physics Science Learning. *Journal of Physics: Conference Series*, 1028(1). <https://doi.org/10.1088/1742-6596/1028/1/012200>
- Thomas, R., Baker, M., Cross, C., & Miehl, M. (2018). Value of Using STEM Professionals in the K-12 Classroom: Connecting Chemistry to The Real World. *ACS Symposium Series*, 1297, 33–41. <https://doi.org/10.1021/bk-2018-1297.ch002>
- Wahyuningsih, A. S., & Rohmah, D. J. (2017). Pengembangan Modul Praktikum Kimia Dasar Berbasis Green Chemistry Untuk Mahasiswa Calon Guru Ipa. *Jurnal Pena Sains*, 4(1), 43–51. <https://journal.trunojoyo.ac.id/penasains/article/view/2857>
- Yulianto, E., & Rohaeti, E. (2013). Pengembangan Majalah Kimia Untuk Meningkatkan Motivasi Belajar dan Kreativitas Peserta Didik Kelas X SMAN 1 MLATI. *Jurnal Pendidikan Sains*, 01(1), 26–36.