Feasibility of Teaching Module in Curriculum Merdeka Integrated *Green Chemistry* to Improve Science Process Skills and Student Learning Independence

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Abstract: The implementation of the Curriculum Merdeka was already implemented in 2022. Teaching modules are one of the new terms in the implementation of the Curriculum Merdeka (IKM). Teaching module is another name for lesson plans (RPP) in the 2013 Curriculum, but it is more complex and can be used as teaching materials that can be modified by teachers. Science learning, especially chemistry, requires students to understand science facts and concepts in daily life. Therefore, it is necessary to develop teaching modules that can make learning more contextual. An approach that can be integrated into developing teaching modules is the green chemistry approach. Chemistry learning, which is generally abstract, can be linked to the environment so that learning can be more contextual. The development of teaching modules that contain learning steps and integrate the principles of green chemistry in the form of experimental activities is expected to increase students' learning independence and science process skills. This research is a type of development research that refers to the steps of the ADDIE model. The feasibility of the teaching module developed was analyzed using a Likert scale and a percentage of agreement (PA) formula. Based on calculations, the average validity value of the teaching module was 3.9, with very valid category. Meanwhile, the percentage of agreement obtained 79%, which means the teaching module is reliable. Based on these conclusions, the teaching module developed is feasible to use because it is included in the valid and reliable category.

Keywords: *Teaching module feasibility, Green Chemistry, Science Process Skills, Learning Independence*

Introduction

The Curriculum is an important thing in the world of education. The curriculum is the goal of where education will be carried out (Salsabilla et al., 2023). The curriculum, in line with the times and advances in technology, is evaluated and improved every time by policy makers, the government, and implemented in the field by subject teachers (Marlina, 2022). Currently, the government has implemented an independent curriculum. In its implementation, the government, implicitly, formulated this curriculum to adapt learning corridors to student characteristics and achievement levels (Syahria, 2022). Educators must have a proactive attitude towards curriculum changes (Jenkins, 2020). Of course, educational institutions must also be responsive in adapting to curriculum changes (Howson et al., 2021).

Nowadays, Merdeka Curriculum teaching module is considered a tool for the fluency implementation of learning with new modes or paradigms, especially when linked to the transformation of the industrial and digital

revolutions (Maipita et al., 2021). The Merdeka Curriculum teaching module refers to a number of tools or media facilities, methods, instructions and guidelines that are designed systematically, interestingly and, of course, according to the needs of students. The teaching module itself can be said to be an implementation of the Learning Objectives Flow (ATP) which was developed from Learning Achievements (CP) with the Pancasila Student Profile as the target. Teaching modules are arranged according to the phase or stage of student development. Teaching modules also consider what will be learned with clear learning objectives. Of course, the basis for development is also long-term oriented. Teachers also need to know and understand the concept of teaching modules with the aim of making the learning process more interesting and meaningful (Syahria, 2022).

The new curriculum certainly requires teaching modules that are appropriate and relevant to the learning material so that students can understand learning concepts well (Farhana, 2023). Therefore, efforts are needed to develop comprehensive and high quality modules that can be used by students in learning (Mardianti, 2020). Green chemistry integrated project-based learning is a model and concept of meaningful learning which uses authentic situations in the real world as an a priori in the application of learning Fauziah et al., 2019).

In the science learning process, especially chemistry, it is necessary to embed science in a context that is connected to life and apply science in the lives of individuals and students' environments (Tsaparlis, 2017). Chemistry learning can be done by studying phenomena that exist in the surrounding environment so that students are challenged and can play an active role in solving problems given by the teacher related to chemical concepts (Jannah et al., 2020). So teachers need to design learning models that can link chemical concepts with problems that exist in everyday life.

Green chemistry is defined as a model in the process of making products by reducing or eliminating the use of chemicals (Irdhawati, 2016). Green chemical materials or known as green chemistry are related to matters to reduce the formation of waste or rubbish, use of catalysts, use of safe solvents or reagents, use of renewable starting materials, increase energy efficiency, use of environmentally friendly materials and can be recycled. This green chemistry material is one of the new materials in the Independent Curriculum. The aim is to cultivate critical thinking skills, such as analyzing various scientific claims and evaluating symptoms that occur in everyday life (Gunter et al., 2017).

The aim of the Curriculum Merdeka itself is to increase the competence of each student, both soft skills and hard skills (Nadia et al., 2022). The policies in the independent curriculum are useful for helping educators and students become creative, innovative, independent in thinking, independent, and make education and students happy and content in carrying out the learning process (Angga et al., 2021). So teacher innovation is needed in developing teaching modules that can facilitate student learning independence and science process skills in learning.

This research aims to describe the feasibility of a teaching module that integrates green chemistry in the Curriculum Merdeka. This module is designed to improve science process skills and develop student learning independence. The advantages of this module include aspects such as applicability, relevance, and positive impact on students' understanding of chemical concepts.

Method

The products developed in this research are teaching modules and research instruments in the form of science process skills tests and learning independence questionnaires. The type of research used in this research is research and development. R&D research is development research, namely research methods used to produce certain products and to test products (Rahmawati et al., 2023). The development model

used in this research is the ADDIE model where the ADDIE model includes the stages of analysis, design, development, implementation and evaluation (Sugiyono, 2017). The selection of the ADDIE development model in this research is based on the assumption that the ADDIE development model has clear stages and is easy to understand.

The feasibility of the product being developed is obtained by analyzing the validity and reliability of the product. The validity of the product in the form of an integrated *green chemistry* teaching module and its supporting instruments was analyzed using Likert scale calculations. Instrument validity is then categorized into several levels of validity as shown in Table 1 below.

Table 1. Instrument Validity Level

Score	Average Score	Classification
4	3,26—4,00	Very Valid
3	2,51—3,25	Valid
2	1,76—2,50	Less Valid
1	1,01-1,75	Invalid

(Setiawan & Indana, 2021)

Meanwhile, the Borich method is used to measure the reliability of products that have been developed. The Borich method is also commonly called the Percentage Agreement (PA) method, where Percentage Agreement is the percentage of agreement or agreement between experts in determining scores. The product being developed can be said to be reliable if the percentage of PA value obtained is more or equal to 75%. If the PA value resulting from the analysis is less than 75%, then the product must be tested more clearly by an expert (Borich, 1994).

Result and Discussion

This research is development research which aims to determine the feasibility of the Green Chemistry Integrated Teaching Module to Improve Students' Science Process Skills and Learning Independence. The ADDIE development model has five stages, namely analysis, design, development, implementation and evaluation. In the analysis stage, an initial analysis is carried out which includes needs analysis, performance analysis, and determining teaching materials and learning objectives.

The second stage is the design stage. At the design stage, product design is carried out according to the framework of the independent curriculum teaching module format. The design stage focuses on designing the teaching module and preparing other supporting tools for the framework and content of the teaching module (Nikmatin & Yushardi, 2022). So at this stage a product draft will be produced (teaching module, Science Process Skills test and Student Learning Independence questionnaire). After the design stage, then proceed to the development stage. The framework/components arranged in the teaching module can be seen in figure 1 below.

Figure 1. Basic Framework of Teaching Module

Next, the third stage is the development stage. At this stage, a feasibility test of the initial product draft produced at the design stage is carried out. This feasibility test is carried out by the validator by filling in an expert validation sheet. The validation sheet assessment for the product being developed consists of 4 assessment scales. A score of 4 indicates a product in a very good category, a score of 3 indicates a good category, a score of 2 indicates a poor category, and a score of 1 indicates a poor category. The total score obtained will later be classified based on Table 1.

After the product validity analysis data is obtained, it is then continued to carry out product reliability analysis. Reliability data is obtained from obtaining expert validator scores which are then calculated using the PA formula. The number of validators used consists of 3 expert lecturers in the field of the product being developed. The aspects assessed on the product to determine the suitability of the product being developed include

aspects of content, product appearance, language and product benefits.

The results of the feasibility test in the form of validity and reliability of the integrated green chemistry teaching module and research instruments can be seen in Table 2 and Table 3 below.

Table 2. Product Validity Analysis By Experts

Product	Average	Category
Teaching Module	3,9	Very Valid
Science Process Skills Test	3,9	Very Valid
Learning Independence Questionnaires	3,6	Very Valid

Based on Table 2 above, the research products and instruments developed show the valid category. Meanwhile, the results of the product reliability analysis and research instruments developed can be seen in Table 3 below.

Table 3. Product Reliability Analysis By Experts

Product	$PA_{Average}$	Category
Teaching Module	79%	Realiable
Science Process Skills Test	78%	Realiable
Learning Independence Questionnaires	91%	Realiable

The results of the feasibility test in the form of product validity and reliability show that the Green Chemistry Integrated Teaching Module for Improving Science Process Skills and Student Learning Independence is suitable for use. However, there are still several suggestions provided by expert validators to improve the product being developed. The suggestions given include designing product colors to make the product more attractive, presenting several images/phenomena related to learning activities, and simplifying sentence structures. The suggestions given by the validator are then used as a reference for researchers to make the proper.

Although the results of the validity and reliability of the product obtained are quite high and the product is suitable for use. However, suggestions and comments provided by validators also aim to improve the product before the implementation stage. After the product has been validated and revised, the product that has been developed is suitable for use at the implementation stage. The implementation stage is carried out to test the product on research samples to obtain product effectiveness.

The final stage is the evaluation stage. Basically, product evaluation in the ADDIE development model is carried out periodically during the development process. However, the summative evaluation carried out at this stage includes data processing of the assessment results and conclusions drawn (Suastika & Rahmawati, 2019).

Conclusion

Based on the results and discussions that have been described, it can be concluded that the development of an integrated *green chemistry* teaching module is suitable for improving students' science process skills and learning independence. This can be seen from the results of the validity and reliability analysis which obtained a value of > 3.26, which means it is included in the very valid category. While product reliability reaches an average of > 75%, which means that the product being developed is reliable.

References

Angga, Suryana, C., Nurwahidah, I., Hernawan, A. H., & Prihantini. (2021). Komparasi Implementasi Kurikulum 2013 dan Kurikulum Merdeka di Sekolah Dasar. Jurnal Basicedu, 5(4), 2541–2549. https://doi.org/10.31004/basicedu.v5i4.1230

Borich, G. D. (1994). *Observation Skill for Effective Teaching*. Macmillan Publishing Company.

Farhana, I. (2023). Merdekakan Pikiran dengan Kurikulum Merdeka: *Memahami Konsep Hingga Penulisan Praktik Baik Pembelajaran di Kelas*. Bogor: Penerbit Lindan Bestari.

Fauziah, N., Hakim, A., & Andayani, Y. (2019). Meningkatkan Literasi Sains Peserta Didik melalui Pembelajaran Berbasis Masalah Berorientasi Green Chemistry pada Materi Laju Reaksi. *Jurnal Pijar MIPA*, *14*(2), 31-35.

Gunter, T. Akkuzu, N. & Alpat, S. (2017). Understanding 'Green Chemistry' and 'Sustainability': an Example of Problem-Based Learning (PBL). *Journal: Research in Science & Technological Education*. 35(4), 500-

520. https://www.tandfonline.com/doi/abs/10.1080/02635143.2017.1353964

Howson, C. K., Kingsbury, M., Howson, C. K., & Kingsbury, M. (2021). Curriculum Change As Transformational Learning Curriculum Change As Transformational Learning. *Teaching in Higher Education*, 0(0), 1–20 https://www.tandfonline.com/doi/full/10.1080/13562517.2021.1940923

Irdhawati. (2016). Kimia Hijau dalam Bidang Industri dan Pengolahan Limbah. *Seminar Nasional Green Chemistry*: Peranan dan Aplikasi dalam Mewujudkan Keberlangsungan Masa Depan Indonesia I. FMIPA Universitas Tanjungpura. Pontianak.

Jannah, R. et al. (2020). Pengaruh Penerapan Model Pembelajaran *Problem Based Learning* Terhadap Peningkatan Keterampilan Berpikir Kritis Dan Pemahaman Konsep Siswa. *Spin Jurnal Kimia Dan Pendidikan Kimia*, Vol. 2, No.2, pp. 116-131. https://etheses.uinmataram.ac.id/1527/

Jenkins, G. (2020). Teacher agency: the effects of active and passive responses to curriculum change. *Australian Educational Researcher*, 47(1). https://link.springer.com/article/10.1007/s13384-019-00334-2

Maipita, I., Dalimunthe, M. B., & Sagala, G. H. (2021). The Development Structure of the Merdeka Belajar Curriculum in the Industrial Revolution Era. 163(ICoSIEBE 2020), 145–151. http://digilib.unimed.ac.id/id/eprint/53033

Mardianti, I., Kasmantoni, K., & Walid, A. (2020). Pengembangan Modul Pembelajaran IPA Berbasis Etnosains Materi Pencemaran Lingkungan Untuk Melatih Literasi Sains Siswa Kelas VII di SMP. *BIO-EDU: Jurnal Pendidikan Biologi*, 5(2), 97-106. http://jurnal.unimor.ac.id/JBE/article/view/545

Marlina, E. (2023). Pembinaan Penyusunan Modul Ajar Kurikulum Merdeka Belajar pada Guru Sekolah Menengah Pertama (SMP). *Journal of Community Dedication*, 3(1), 88-97. https://adisampublisher.org/index.php/pkm/article/view/266

Nadia, D. O., & Erita, Y. (2022). Merdeka Belajar Dalam Perspektif Filsafat Konstruktivisme. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 7(2), 878-887. https://journal.unpas.ac.id/index.php/pendas/article/view/6824

Nikmatin Mabsutsah, & Yushardi, Y. (2022). Analisis Kebutuhan Guru terhadap E Module Berbasis STEAM dan Kurikulum Merdeka pada Materi Pemanasan Global. *Jurnal Pendidikan Mipa*, 12(2), 205–213. https://doi.org/10.37630/jpm.v12i2.588

Rahmawati, T., Nurhasanah, N., Habibi, M. A. M., & Suarta, I. N. (2023). Journal of Classroom Action Research. *Journal of C;Assroom Action Research*, 5(1), 163–170. https://doi.org/10.29303/jcar.v5i1.2766

Salsabilla, I. I., Jannah, E., & Juanda, J. (2023). Analisis Modul Ajar Berbasis Kurikulum Merdeka. *Jurnal Literasi Dan Pembelajaran Indonesia*, 3(1), 33-41. https://jurnalfkip.samawa-university.ac.id/JLPI/article/view/384

Setiawan, E., & Indana, S. (2021). Validitas Lkpd Berbasis Pjbl Pada Materi Klasifikasi Tumbuhan Spermatophyta Untuk Melatih Ketrampilan Berpikir Kreatif Siswa Kelas X Sma. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, 10(2), 250-256. https://ejournal.unesa.ac.id/index.php/bioedu/article/view/38580

Suastika, I. K., & Rahmawati, A. (2019). Pengembangan modul pembelajaran matematika dengan pendekatan kontekstual. *Jurnal Pendidikan Matematika Indonesia*, 4(2), 60. https://core.ac.uk/download/pdf/300026131

Sugiyono, (2017). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.

Syahria, N. (2022). Pengembangan Modul Ajar Kurikulum Merdeka Mata Pelajaran Bahasa Inggris SMK Kota Surabaya. *GRAMASWARA*, 2(2), 49-62. https://gramaswara.ub.ac.id/index.php/gramaswara/article/view/35

Tsaparlis, G. 2017. Problems And Solutions In Chemistry Education. *Journal of Turkhis Chemical Society and Chemical Education*, 1(1)1-30. https://dergipark.org.tr/en/pub/jotcsc/issue/30533/330309