JURNAL PENDIDIKAN KIMIA
ISSN: 2085-3653| e-ISSN: 2549-3116
Vol. 14 | No. 1 |39 - 46| April | 2022
https://doi.org/10.24114/jpkim.v14i1.32112

Development of chemic media (chemistry comic) based on problem based learning on chemical bond materials for class x students

Selly Aprilia Nisa[1,*], Meli Sartika Silaban[1] and Saronom Silaban[2]

[1]Chemical Education Study Program, Faculty of Mathematics and Sains, Universitas Negeri Medan, Medan 20221, Indonesia
[2]Department of Chemistry, Universitas Negeri Medan, Medan 20221, Indonesia
*Corresponding author: SAN, sellyaprilia9887@gmail.com

Received: 14 January 2022 **Revised:** 04 March 2022 **Accepted:** 04 April 2022

ARTICLE INFO

Keywords:
ADDIE model
Chemic media
Chemical bonding
Problem based learning

ABSTRACT

This research is a development research that aims to determine the feasibility of chemic media based on problem based learning on chemical bonding material for class X students based on BSNP standards. In this research, a modified ADDIE development model was used where only the analysis, design, development and evaluation stages were carried out. This research will be conducted at the Department of Chemistry State University of Medan, SMAN 1 Secanggang and SMAS Bintang Langkat. The feasibility of the media is seen through a feasibility questionnaire based on the BSNP standard with a Likert scale of 1 to 5. The validity of the chemic media is obtained from the results of the validation of lecturers and teachers, while the respondents' assessment of chemic media is obtained from the results of the assessments of teachers, students, and students. The results obtained indicate that the chemical media developed is valid or feasible to use. This can be seen from the validation data in terms of content, presentation feasibility, language feasibility, graphic feasibility and problem based learning assessment, respectively, obtaining a percentage of 80.83%, 82.50%, 94.38%, 82.19%, and 82.14% so that an average percentage of 82.00% is obtained which is included in the very high category. The results of respondents' assessments of chemic media were reviewed based on aspects of appearance, material and benefits which respectively obtained a percentage of 88.96%, 86.73%, and 86.67% with an average percentage of 87.6% which is included in the very high category.

1. Introduction

The success of teaching and learning process can be achieved when some aspects of it run in harmony, such as the aspects of learners, educators, and learning resources. In this process the position of media is quite important. Learning media greatly helps the effectiveness of the learning

process and the delivery of information or lesson content (Kustandi & Sucipto, 2011; Muchtar et al. 2020; Silaban, 2021; Siahaan et al. 2021).

In chemistry learning, learning media is needed to help the implementation of the teaching and learning process. Considering that the material in chemistry are dominantly abstract so it is difficult to understand them if they are only explained contextually, especially in chemical bonding materials. Having a good understanding of concepts will make students easier to learn the chemical bonding materials that have many concepts (Ozmen, 2004).

Based on the results of interviews with one chemistry teacher of SMAN 1 Secanggang it was known that learning on chemical bonding materials has been conducted by only using textbooks. Learning chemical bond with textbooks is less attractive for students. The results of the above interview are in line with the results of observations made on 40 students which revealed that some students do not like chemical bonding materials because the material is difficult to understand, less interesting, and boring. Students also state that chemical bond learning has been delivered only using textbooks.

The results of the analysis on the comic media by Muhaimin et al (2015) showed that this media still contains limited material which was only about ion bonding materials and covalent bonds. In addition, this comic media is not based on problem-based learning (PBL), there is no summary of material, glossary and bibliography, and the problem of training in comic media has not been in accordance with the indicators of achievement. Based on the results of analysis that has been done on the chemical comic media by Muhaimin et al (2015), it was concluded that the chemical comic media that has been developed still has some shortcomings that can be used as the basis of thinking for the development of the next chemical comic media in order to produce a better chemical comic (chemic) media.

Chemic media to be developed on this chemical bond meteri applies the PBL model (Harahap et al. 2018). The use of PBL models in chemic media can lead learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop viable solutions to a problem (Strobel & van-Barneveld, 2009). In this study, researchers offered a PBL chemic media as one of the efforts to overcome the above problems. PBL chemic media is a book that contains chemical bonding materials in the form of comic and PBL. The main role of comics in instructional is its ability to develop student's interest in learning (Fawaidah, 2016). Based on the description, the purpose of this research is to produce a chemic media based on problem based learning on chemical bonding materials.

2. Methods

This research is a type of research and development (R&D) research design. This kind of research used to produce particular products (Manalu et al. 2016; Sariani, 2017). In this research the product is the learning product (Manalu et al. 2018; Pakpahan et al. 2021). This research used the ADDIE model but in incomplete form where is only the analysis stages, design, development and evaluation, without the implementation stage. In this study, implementation was not carried out because the purpose of this study was to produce chemical media on chemical bonding materials. So that it can be said that the researcher uses the modified ADDIE method, where only the analysis, design, development, and evaluation stages are carried out.

The sample in this study were (1) 4 chemistry teachers selected from 2 high schools in Langkat Regency namely State SMAN 1 Secanggang and SMAS Bintang Langkat; (2) 5 students of the Department of Chemistry of Medan State University enrolling year of 2018; and (3) 5 students of grade XI at SMAN 1 Secanggang. The samples were randomly assigned to the study with the random sampling cluster technique.

The data collected in this research is in the form of descriptive qualitative data. In this research, the data collecting techniques include descriptive qualitative data obtained from the responses or

validation by experts and teachers (Table 1). This also used responses from users who were teachers and students towards the PBL-based chemic (chemistry comic) media.

Table 1. Suspension on Angket Based on Likert

No.	Choice of answers	Score
1	Strongly Agree (SS)	5
2	Agree (S)	4
3	Agree enough (KS)	3
4	Disagree (TS)	2
5	Strongly Disagree (STS)	1

Calculating the percentage of answer questionnaires in each statement using the calculation formula in Sudjana (2005), is as follows:

$$\%X_{in} = \frac{\sum S}{S\ maks} \times 100\ \%$$

$\%X_{in}$ = percentage of the answer of the i-statement on the questionnaire

Calculating the average percentage of answers per questionnaire to determine the level of conformity of content, presentation, language, graphing and problem based learning in chemic media (chemisttry comic) based on problem based learning in chemical bonding materials with the calculation formula Sudjana (2005), is as follows:

$$\overline{\%X_t} = \frac{\sum \%X_{in}}{S\ maks} \times 100\ \%$$

$\%X_t$= average percentage of answers to statements on the questionnaire

Table 2. Interpretation of Angket

Percentage (%)	Criterion
80,1 - 100	Very high
60,1 - 80	High
40,1 – 60	Enough
20,1 – 40	Low
0,0 - 20	Very low

Table 3. Percentage Analysis Validation

Percentage (%)	Validity level	Information
76 - 100	Valid	It's worth/doesn't need to be revised
51 - 75	Valid enough	Quite decent/partial revision
26 – 50	Less valid	Less viable/partial revision
<25	Invalid	Less worthy/total revision

The percentage value of the questionnaire is interpreted using interpretation of Arikunto (2008) based on the following Table 2. Interpreting the validation criteria for the percentage analysis of expert validation products and response results from respondents using interpretation of Arikunto (2008) based on the following Table 3.

3. Results and Discussion

3.1. Analysis Stage

This stage aims to establish the basic direction required in the development of this learning media. At this stage, previous media analysis was carried out, namely the chemical comic media by Muhaimin et al (2015). The analysis was conducted by providing an assessment using the same validation instrument used, the BSNP standard feasibility instrument to look at the feasibility of the chemical comic medium being developed.

Based on the results of the analysis of chemical comics by Muhaimin using BSNP questionnaires it was obtained the result that the media was in a fairly valid category with a moderate percentage category. This was seen based on the assessment percentage of 60.02%. Tabulation of data from muhaimin's chemical comics can be seen in Table 4.

Table 4. Tabulation of The Results of Muhaimin's Chemical Comic Analysis

Aspects	Answer score	Percentage	Percentage criteria
Content eligibility aspects	32	53.33%	Enough
Presentation eligibility aspects	26	52.00%	Enough
Language eligibility aspects	32	71.11%	High
Graphics eligibility aspects	111	69.38%	High
Problem based learning assessment aspects	19	54.26%	Enough
Average		60.02%	Enough

The results of muhaimin's chemical comic analysis showed a percentage of the aspects of content feasibility, presentation feasibility, language feasibility, graphability and problem based learning assessment of 53.33%, 52.00%; 71.11%; 69.38%; and 54.26%. So the average of these five aspects was 60.02%. It can be interpreted that muhaimin's chemical comics was in the category quite valid and require partial revision. Muhaimin's chemistry comics still have some shortcomings that can be used as a rationale for the development of chemic media based on the problem-based learning in the chemical bonding materials.

3.2. Design Stage

At this stage there is a systematic process that starts from setting research goals and designing learning media in conceptual form that will underlie the next development process (Sari, 2017). The development of chemic media based on problem-based learning on chemical bonding materials aimeds to produce better and innovative chemical comic media and was suitable for use in chemical bond learning for high school students.

There are submatter chemical bonds discussed in this chemic medium including: (1) the stability of the element and the structure of lewis; (2) chemical bonds; (3) intermolecular style; (4) the polarity of the compound; and (5) the shape of the molecule.

In the chemic media (chemistry comic) based problem based learning (PBL) design, the steps of making it are: (1) make a summary of the material; (2) create a comic storyboard; (3) describe the character in the comic; (4) sketching comics; (5) add appropriate images or illustrations; (5) coloring; (6) add a complementary component to the comic; (7) design the cover of the comic; and (8) to print media chemic (chemistry comic) (Praptiwi et al. 2020).

This chemic medium contains chemical bonding materials designed in comic form. In the first step at this stage of development, a discussion of material on chemical bonding materials obtained from relevant sources and in accordance with the applicable 2013 curriculum syllabus. Furthermore, the design of the storyline is adjusted to the steps at the PBL stage with chemical bonding materials that are adapted to problems in everyday life.

The next stage is the stage of sketching comics on chemic media. Comic sketches are created as the initial act of a comic story drawing. Chemic media is drawn using digital techniques (Figure 1).

After the sketch is designed, then the addition of appropriate illustrations and also coloring (Figure 2). The next step is to add a complementary component to the comic. Comic images that have been created, then arranged into a document file to enter text and dialogue on chemic media (Figure 3).

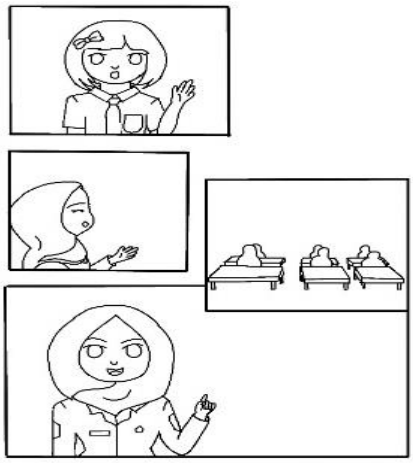

Figure 1. Comic Sketches in Chemic Media

Figure 2. Chemic Media After The Stage of Adding Illustration and Coloring

Figure 3. Chemic Media After the Text Addition Stage

3.3. Development Stage

Chemic media that have been designed at the design stage, then finalized based on the validator's suggestions and assessment (Figure 4). Chemic media that has been compiled then continued with validation activities conducted by experts. Validation was carried out by 4 experts, of whom 3 were lecturers of Medan State University and 1 chemistry teacher at SMAN 1 Secanggang. Validation assessments are conducted using validation questionnaires based on BSNP standards. The aspects assessed in the validation assessment include: (1) aspects of content feasibility; (2) aspects of the feasibility of presentation; (3) aspects of language eligibility; (4) aspects of the feasibility of the graph; and (5) aspects of problem based learning assessment. The results of chemic media validation conducted by experts can be seen in Table 5.

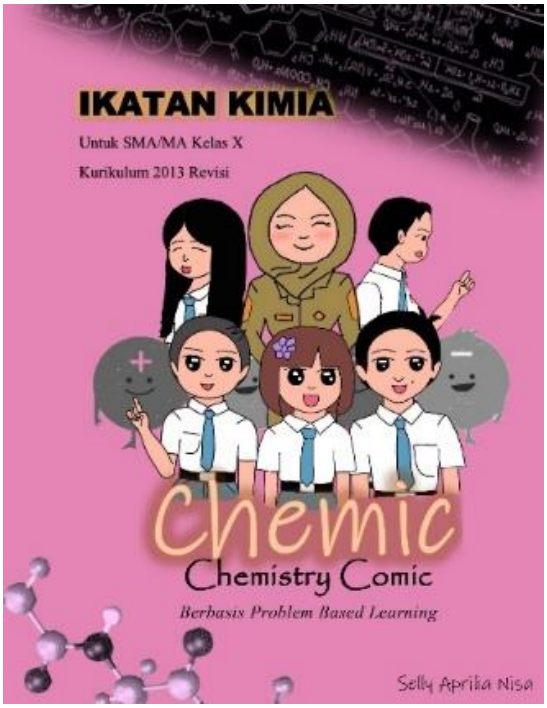

Figure 4. Chemic Media Cover Design

Based on the table data above, it can be known that the results of validation assessments in each aspect are 80.83% for the aspect of content feasibility, 82.50% for the aspect of presentation feasibility, 94.38% for aspects of language feasibility, 82.19% for aspects of ability of graphing and 82.14% for aspects of PBL assessment. Based on data from chemic media feasibility test based on PBL on chemical bonding materials based on BSNP standards, the average percentage is 84.41% so it can be concluded that this chemic media is valid or worth using and the percentage criteria in the category are very high.

Table 5. Results of Chemic Media Feasibility Analysis Based on BSNP.

Aspects	Average score	Percentage	Percentage criteria
Content eligibility aspects	48.5	80.83%	Very high
Presentation eligibility aspects	41.25	82.50%	Very high
Language eligibility aspects	37.75	94.38%	Very high
Graphics eligibility aspects	130.75	82.19%	Very high
Problem based learning assessment aspects	28.75	82.14%	Very high
Average		84.41%	Very high

3.4. Evaluation Stage

At this stage, the dissemination of chemic media to get an assessment or response to the media that has been developed. The assessment of respondents to the problem-based media chemic (chemistry comic) was conducted by 4 chemistry teachers from 2 high school schools in Langkat district, 5 students of the chemical education study program of Medan State University in 2018, and 5 students of State High School 1 Secanggang. Assessment is carried out using an assessment questionnaire with several aspects of assessment, namely aspects of appearance, material aspects and benefit aspects. Based on the results of the assessment of the three groups of respondents, namely teachers, students and students can be concluded in Table 6.

Table 6. Tabulate the Results of Teacher, Student and Student Assessment of Chemic

Aspects	Average score	Percentage	Percentage criteria
View aspect	40.0	88.96%	Very high
Material aspects	43.4	86.73%	Very high
Benefit aspects	13.0	86.67%	Very high
Average		87.67%	Very high

Based on the data in the table above it can be known that the average percentage value for the display aspect, material aspect and benefit aspect is 88.96%; 86,73%; and 86.67%. From the value of the three aspects assessed in chemic media assessment, the average percentage value was 87.67%. These values can be categorized as a very high percentage, meaning that this chemic media is already suitable for use as a learning medium in chemical bond learning. It can be concluded that the chemic media that has been developed gets an excellent response and assessment. In addition to getting a good response, this medium is also expected to facilitate students in understanding the concepts of chemical bonding that are abstract.

4. Conclusion

Based on the results of the research outlined above, it can be concluded as follows: (1) the results of Muhaimin's chemical comic media analysis based on BSNP standards show an average score of 3.14 with an average percentage of 60.02% in the moderate category and valid enough (quite feasible or partial revision; (2) Problem-based chemic (chemistry comic) media for class X students on Chemistry Bond materials have met the eligibility criteria according to BSNP standards. This can be seen from the average percentage of 84.41% so that this chemic media is valid or worth using and the percentage criteria in the category are very high; and (3) the results of teacher, student and student assessment of problem-based chemic (chemistry comic) media based learning on chemical bonding materials for grade X students is 87.67%. These values can be categorized as a very high percentage.

References

Arikunto, S. (2008). Research procedures a practical approach. Jakarta: Rineka Karya.

Fawaidah, H. (2016). Development chemic (chemistry comic) as a learning media in chemical bonding topic for grade x high schoolstudent. *Unesa Journal of Chemical Education*, 5(3), 621-628. https://doi.org/10.26740/ujced.v5n3.p%25p

Harahap, N. M., Hutabarat, W., & Silaban, S. (2018). The effect of model problem based learning (pbl) assistance of prezi media on student learning outcomes in colloid materials. *Advances in Social Science, Education and Humanities Research*, 200, p. 456-458.

Kustandi, C., & Sutjipto, B. (2011). Manual and digital learning media. Bogor: Ghalia Indonesia.

Manalu, E., Silaban, S., Silaban, R., & Hutabarat, W. (2016). The development of chemical practice guidebook colloid system-based integrated contextual character values. *Jurnal Pendidikan Kimia*, 8(2), 87-89. https://doi.org/10.24114/jpkim.v8i2.4429

Manalu, H. C., Silaban, S., & Hutabarat, W. (2018). The development of teaching materials stoichiometric integrated multimedia easy sketch. *Advances in Social Science, Education and Humanities Research*, 200, 352-356.

Muchtar, Z., Rosalia, A. V. A., & Silaban, S. (2020). Implementation of dubido based on contextual in improving students achievement on rate reaction. *Journal of Physics: Conference Series*, 1462, p. 012053. https://doi.org/10.1088/1742-6596/1462/1/012053

Muhaimin, M., Syahri, W., & Kurniawan, E. D. A. (2015). Pengembangan media pembelajaran komik kimia menggunakan 3D page flip untuk materi ikatan kimia siswa SMA negeri 10 kota Jambi. *Journal of Indonesian Society of Integrated Chemistry*, 7(1), 34-44. https://doi.org/10.22437/jisic.v7i1.4839

Ozmen, H. (2004). Some student misconceptions in chemistry: A literature review of chemical bonding. *Journal of Science Education and Technology*, 13(2), 147-159. https://doi.org/10.1023/B:JOST.0000031255.92943.6d

Pakpahan, D. N., Situmorang, M., Sitorus, M., & Silaban, S. (2021). The development of project-based innovative learning resources for teaching organic analytical chemistry. *Advances in Social Science, Education and Humanities Research*, 59, p. 782-788.

Praptiwi, F. A., Kurniawan, R. D., & Hidayah, R. (2020). The effect of chemiclife media on chemical bond material based on completeness and student learning outcomes. *Advances in Engineering Research*, 196, p.172-175.

Sari, B. K. (2017). Desain pembelajaran model ADDIE dan implementasinya dengan teknik jigsaw. *Prosiding Seminar Nasional Pendidikan*, p. 87-102.

Silaban, S. (2021). Pengembangan program pengajaran. Medan: Yayasan Kita Menulis.

Siahaan, R., Sitorus, M., & Silaban, S. (2021). The development of teaching materials oriented to critical thinking skills for chemistry class XI high school. *Jurnal Pendidikan Kimia*, 13(1), 60-68. https://doi.org/10.24114/jpkim.v13i1.24145

Strobel, J., & Van Barneveld, A. (2009). When is PBL more effective? A meta-synthesis of meta-analyses comparing PBL to conventional classrooms. *Interdisciplinary Journal of Problem-Based Learning*, 3(1), 44-58. https://doi.org/10.7771/1541-5015.1046

Sudjana, N. (2005). Statistical Method. Bandung: Tarsito.