

# Development of Chemistry Comics as Alternative Learning Media on Electrolyte and Non Electrolyte Solution for Grade X SMA

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## ABSTRACT

This study aims to produce a media as alternative learning media of chemistry comic on the material Electrolyte and Non Electrolyte for grade X of SMA and determine of the validity and practicality of resulting media. The type of research used research and development (Research and Development / R&D). The development model used 4-D (Four D Models), consisting of four stages, namely define (pendefinisian), design (perancangan), develop (pengembangan) and desiminate (penyebaran). This research determines the level of validity and practicality of the developed chemistry comic media. The media of chemistry comic was validated by two chemistry lecturers from FMIPA UNP and two chemistry teachers from SMAN 2 Payakumbuh. Determination of the practicality level of chemistry comic media by three chemistry teachers from SMAN 2 Payakumbuh and 27 students of Class X MIPA 1 SMAN 2 Payakumbuh. The instrument used was a questionnaire of validity and practicality. The results of the validity questionnaire analysis obtained a very high level of media validity with a kappa moment value of 0.85. While the practicality analysis results based on the teacher and student response questionnaire received kappa moment values of 0.93 and 0.88 respectively, with a very high practicality category. It can be concluded that the chemistry comics made can be used as learning media on Electrolyte and Non-Electrolyte Solution material for grade X SMA.

**Keywords:** Alternative Learning Media, Chemistry Comics, Electrolyte and Non Electrolyte Solutions, 4-D Development Model.

## INTRODUCTION

Material of electrolyte and non-electrolyte solution was studied in the second semester in class X SMA / MA. This material learns about the characteristics of electrolyte and non-electrolyte solutions, the type of solution based on the conductivity of electricity, the cause of electrolyte solutions can deliver electric current and the types of bonds found in electrolyte and non-electrolyte solutions. Material of electrolyte and non-electrolyte solution is material related to daily life, students not only memorize and understand concepts but also relate to everyday life. <sup>[1]</sup>

Through learning trends, many media are used to support learning. From this approach, it can be seen how the quality of the world of education in the future or currently on going. It also cannot be separated from the learning process carried out in the classroom by using media. Media is one of the tools used to help facilitate educators in delivering subject matter to students. The media is adapted to the material to be taught. Various examples of learning media such as macromedia flash, molimod, snakes and ladders, monopoly, novels, short stories and comics. Each of these learning media has advantages and disadvantages. The learning process will take place not optimal and communication will also not be maximized without the learning media. <sup>[2]</sup>

Based on data from observations at SMAN 2 Payakumbuh, as much as 68% of students more easily understand the lesson with the help of pictures and colors. According with this, 56.4% of students answered that they preferred to read comics rather than textbooks and 91% they liked to read comics. Based of the source, as much as 89.6% answered that the chemistry comic media could be made as a source of independent learning. Meanwhile, based on data from observations at SMAN 4 Payakumbuh, as much as 90.3% of students prefer books with pictures and colors so that interest in reading and understanding the concepts of the material presented will be better controlled. Around 61.29% prefer to read comics and 58.06% answered students would rather read comics than read textbooks. Regarding learning resources in the form of comics, 80.6% answered that they had never used learning resources from comics, especially specifically chemistry subjects and 70.96% answered learning resources could be made from comics. The lack of variety of learning media used in schools makes students less likely to be interested in reading books that contain a lot of verbal expressions, because they prefer interesting media and have lots of pictures.

Comic media is one of the media that can be used as a source of independent learning for students. Based on the results of interviews with chemistry teachers and the results of student questionnaire responses, students are more interested in books that have more pictures and attractive colors. Comics are media that are synonymous with images and language in clear and concise conversation. The reader can easily understand the storyline created by the comic. With the concept of contextual learning accompanied by pictures can foster students' ability to read interest and clear understanding of the material. <sup>[3]</sup>

Problems that arise related to making comics on electrolyte and non-electrolyte solution material for high school class X are students who have difficulty understanding the concepts of polar and

non-polar, types of bonds in electrolyte and non-electrolyte solutions as well as examples in electrolyte and non-electrolyte solutions. The use of teaching materials by teachers is only in the form of textbooks or textbooks that are borrowed through the school library, worksheets and powerpoint learning media displayed on the projector. The lack of learning media in this case is visual media, making students more bored in the learning process. Though their interest in learning about chemistry is very high, but because it is not supported by the right media so they are less motivated in reading and studying chemistry.

Therefore we need a learning media that can foster student learning motivation so that it makes it easier for them to understand the material being taught when to study independently according to what is demanded by the 2013 curriculum. Aims of making chemistry comic is make it easier to learn independently and as an alternative learning media that are expected to be used anywhere not only in the classroom, but outside the classroom can also.

The purpose of this study is to produce an alternative learning media in the form of chemistry comics that can be used on electrolyte and non-electrolyte material for class X high school and determine the level of validity and practicality of learning media in the form of chemistry comics on Electrolyte and Non-electrolyte solution for Class X Senior High School.

## **LITERATURE REVIEW**

The media comes from the Latin "medium", located in the middle of one intermediary that can deliver messages from the sender to the recipient of the message. The media is a means of delivering information in the form of channels given by the sender to the recipient of the information. <sup>[4]</sup> Alternative media are media that are used besides the main media. In this case, alternative media has the same function and purpose as the main media. When the main media can no longer be used, alternative media can be used to

support the learning process so that what is conveyed in learning is achieved. [5]

The alternative media is designed and developed by itself according to the needs and existing infrastructure. Similar to the main media, alternative media must be adapted to the needs of the school and be able to attract the attention and interest of students in learning, so that it will support the efficiency and effectiveness of the learning process and outcomes. [6]

From the description above, it can be concluded that alternative learning media is a form of tool used to support learning. So that learning can be carried out in accordance with a scientific approach.

Media grouping is based on the senses used, visual media including the media that delivers the message in the form of visual senses. The function of visual media according to Levie and Lentz, namely the attention function, affective function, cognitive function and compensatory function. [7] The word comic comes from the English "comic" which means something that makes it funny. From the etymology or terms of the language it can be drawn meaning that comics are identical with funny things. Funny in terms of pictures, colors and content from the contents of the comic. [8] Images and symbols that are organized in a specific order aimed at providing information and achieving aesthetic responses from readers are called comics. [9]

From some comic understanding according to the experts above, it can be said that comic is a learning media that can give a message, acted by several characters, accompanied by pictures so that it can attract the reader's interest. [10]

Based on the type of story, chemistry comics is educational comics. In this case, chemistry comics refer to comics that contain teachings or other material that has educational value for the reader. Not only that, this comic also has two goals at once, namely the purpose of education and entertainment purposes. [11] In addition, chemistry comics are also included as

"science comics", because comics aiming at one of them to communicate other scientific or scientific matters, so as to increase knowledge from readers. [12]

Comics have advantages that can be used as a reason why a comic can be used as a medium of learning or learning resources. This is possible because comics combine the power of images and writing that are strung together into an interesting story line and contains information that is more easily absorbed. [13]

Based on empirical data, students' tendency can be seen from what they like in learning. Students prefer to read books that are illustrated, full of color and can be visualized so they do not float when imagining what they are reading. This can be seen for example like a cartoon. [6] Besides, comics can also make students faster and easier to remember what they read about the material because the information written is short, concise and contains. [14]

The suitability of chemistry material is applied to comic media, first, material that has an abstract concept and requires a better understanding, such as chemistry bonds, electrolyte and non-electrolyte solutions, stoichiometry, redox and others. Second, the material is too much memorization and makes students more likely to be lazy to read learning resources, such as petroleum, colloids, nomenclature compounds and others. In line with this, the delivery of material that is difficult to understand by students is explained by verbal sentences without any supporting media to visualize causing students to be more difficult to understand. [15]

## **MATERIALS & METHODS**

### **Types of Research**

This research is to produce a product and test the effectiveness level. [16] The development model used in this study is the 4-D model (Four D Models) developed by Thiagarajan and Sammel in 1974. The 4-D model consists of four stages of development, namely Define (defining),

Design (planning), Develop (planning) and Desiminate (deployment).<sup>[17]</sup> However, this research was only carried out at the Development stage, due to material and time constraints.

The final result of this study is a product in the form of alternative comic chemistry learning media on electrolyte and non-electrolyte solution material for valid and practical class X SMA This research was conducted at SMAN 2 Payakumbuh. This research will be conducted in the even semester of 2019/2020 school year. The subjects of this study were two lecturers from the Department of Chemistry FMIPA UNP, three chemistry teachers at SMAN 2 Payakumbuh and high school students in class X SMAN 2 Payakumbuh. The object of this research is an alternative media for learning comics chemistry on the material of Electrolyte and Non-Electrolyte Class X SMA.

### Research Instrument

The instrument used in this study was a questionnaire of validity and practicality. This questionnaire is useful for determining the level of validity and practicality of the resulting alternative learning media.

### Data Analysis Techniques

The data analysis technique used is descriptive data describing the level of validity and practicality of alternative learning media for chemistry comics that were developed. The data obtained is then calculated using the Cohen Kappa formula, where at the end of the data processing a Kappa Moment will be obtained.

Kappa Moment Formula:

$$\text{Momen Kappa } (\kappa) = \frac{\rho_o - \rho_e}{1 - \rho_e}$$

Information:

$\kappa$  : Kappa moment that shows product validity.

$\rho_o$  : Realized proportions are calculated by the number of values given by the validator divided by the maximum number of values.

$\rho_e$  : Unrealized proportion, calculated by means of the maximum value reduced by the total number of validated values divided by the maximum number of values.

Kappa moment values ( $\kappa$ ) range from 0 to 1. Interpretation of kappa moments is presented in Table 1.

Table 1. Decision Categories based on Kappa Moments (K)<sup>[18]</sup>

Interval	Kategori
0,81 – 1,00	Almost perfect
0,61 – 0,80	Substansial
0,41 – 0,60	Moderate
0,21 – 0,60	Fair
0,01 – 0,20	Slight
≤ 0,00	Poor

## RESULT

### 1. Define

#### a. Front End Analysis

The purpose of this front end analysis is to bring up the basic problems faced by teachers and students in learning chemistry, specifically the material Electrolyte and Non Electrolyte Solutions. The data analyzed were generated from data from interviews with chemistry teachers and questionnaires given to students of SMAN 2 Payakumbuh and SMAN 4 Payakumbuh. The result data states that the media used by teachers in schools are power point media, teaching materials used in schools are textbooks and worksheets. The handbooks that are available are adequate but do not attract students' interest in reading. Students prefer pictorial and colorful learning media and the unavailability of comic learning media, especially in chemistry subjects. In the use of instructional media, teachers use power point media. Although students look happy, they expect new variations of learning media that are more interesting and illustrated and have colors.

#### b. Student Analysis

This analysis aims to determine the characteristics of students in learning. Based on the results of the analysis of the distribution of questionnaires at SMAN 2 Payakumbuh and SMAN 4 Payakumbuh, it was found that students need a variety of learning media that can foster and increase



their interest in learning. Most students find it easier to understand lessons with lots of pictures and colors, so students agree that a learning medium is designed in the form of comics on the material Electrolyte and Non-Electrolyte Solutions.

### c. Task Analysis

In this task analysis is an analysis of the main tasks that students must master in order to achieve minimal competence. This analysis is an analysis of Core Competencies (KI) and Basic Competencies (KD). Based on the KI and KD analysis contained in the syllabus, Competency Achievement Indicators (IPK) can be formulated. In the material Electrolyte and Non-Electrolyte Solution, the Basic Competence (KD) students must achieve is KD 3.8 Analyzing the nature of the solution based on its electrical conductivity. While indicators of competency achievement that must be achieved by students include, 3.8.1 analyzing the nature of electrolyte and non-electrolyte solutions, 3.8.2 analyzing the cause of electrolyte solutions can conduct electric current, 3.8.3 analyzing the types of bonds in electrolyte solutions.

### d. Concept Analysis

Concept analysis is the identification of the main concepts that will be discussed in the material electrolyte and non-electrolyte solutions.

## 2. Design

The design phase aims to design chemistry comics on electrolyte and non-electrolyte solution materials based on basic competencies according to the 2013 revised 2018 curriculum. The process of making chemistry comics uses digital methods, where the digital method is the process of making pure comics using digital technology. The tool used in this technology does not touch the tool like conventional tools. The use of digital devices such as tablets or computers. So that all processes are purely digital.

The first step in making chemistry comics is the creation of story scripts and the determination of character figures, then

the text is converted into rough sketches and then colored. The application used is Adobe Photoshop CS6. The initial step in designing the developed chemistry comic product can be seen in Figures 1 to 3.

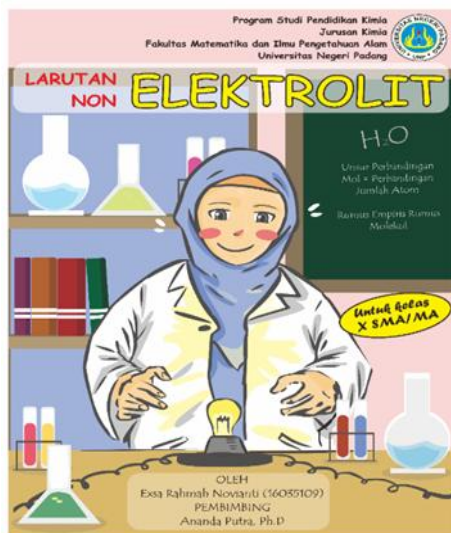


(a)



(b)

Figure 1. (a) Sketch of comic and (b) comic have been colored



(a)

**PENGENALAN TOKOH**

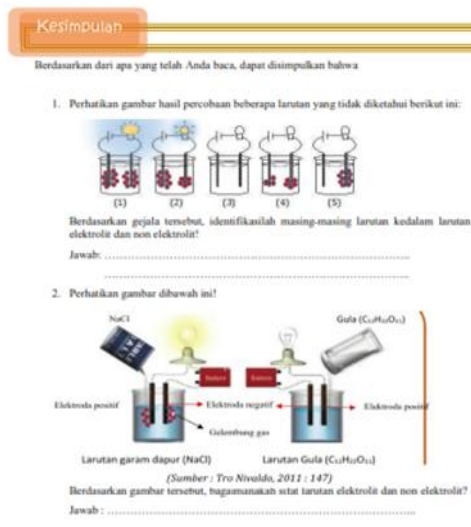


(b)

Figures 2. (a) Comic Cover and (b) Introduction of characters

Kompetensi Inti dan Kompetensi Dasar	Indikator Pencapaian Kompetensi
<p>A. Kompetensi Inti</p> <p>K1. Menghargai dan mengambalikan jasa-jasa yang diterima</p> <p>K2. Mengetahui dan menggunakan perilaku jujur, disiplin, tanggungjawab, peduli (lingkang, ringkas, bersih, disiplin), santun, rasa hormat dan peduli dan bertanggung jawab sebagai bagian dari keberagaman sosial dan budaya serta mampu menunjukkan dan sebagai sesama warga dalam pergaulan dunia.</p> <p>K3. Menelaah, menalar, menguji, mengkonstruksi, dan mengkonstruksi, pengetahuan, dan keterampilan, serta berinteraksi dengan sesama, berkolaborasi, berinovasi, berkreasi, berprestasi, dan berprestasi sebagai pribadi, berprestasi dan berprestasi, serta menunjukkan pengetahuan, dan keterampilan yang unggul, serta dengan baik dan santun serta menunjukkan masalah.</p> <p>K4. Mengambil, menelaah, dan menelaah dan menelaah dan menelaah serta dengan pengetahuan dan yang dipelajarinya di sekolah serta menelaah, dan menelaah menelaah menelaah menelaah menelaah.</p> <p>B. Kompetensi Dasar</p> <p>1.1. Mengenal sifat larutan berdasarkan daya hantar listriknya</p>	<p>3.1.1. Mengenal sifat larutan elektrolit dan non elektrolit</p> <p>3.1.2. Mengenal penyebab larutan elektrolit dapat menghantarkan arus listrik</p> <p>3.1.3. Mengenal jenis larutan pada larutan elektrolit</p>

(a)



(b)

Figure 3. (a) Core, Basic and indicator (KI, KD dan IPK) and (b) Conclusion

**3. Develop**

In the develop phase, the aim is to produce learning media in the form of chemistry comics on the revised Electrolyte and Non-Electrolyte materials based on input from the validator.

**a. Validity test**

Validation was carried out by two Chemistry lecturers from the Faculty of Mathematics and Natural Sciences UNP and two Chemistry teachers from SMAN 2 Payakumbuh as validators. The level of product validation is based on four functions of the visual media, namely the attention function, affective function, cognitive function and compensatory function. The results of the validation test analysis can be seen in Figure 4.

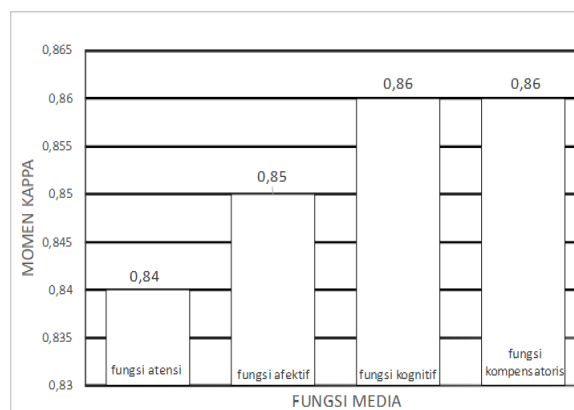


Figure 4. The results of the analysis of the validity of chemistry comics tests on Electrolyte and Non Electrolyte Solutions; Media function of Kappa moments

### a. Practicality Test

Practicality test aims to determine the practicality of chemistry comics learning media on the material Electrolyte and Non-Electrolyte solution based on the results of field trials. The level of product practicality is based on three aspects obtained based on the opinions of several experts namely ease

of use, time efficiency and attractiveness and benefits. The determination of the level of practicality was carried out by three chemistry teachers at SMAN 2 Payakumbuh and 27 students of SMAN 2 Payakumbuh class X MIPA 1, by giving questionnaires practicality to each respondent. The results of the practicality test analysis can be seen in Figure 5.

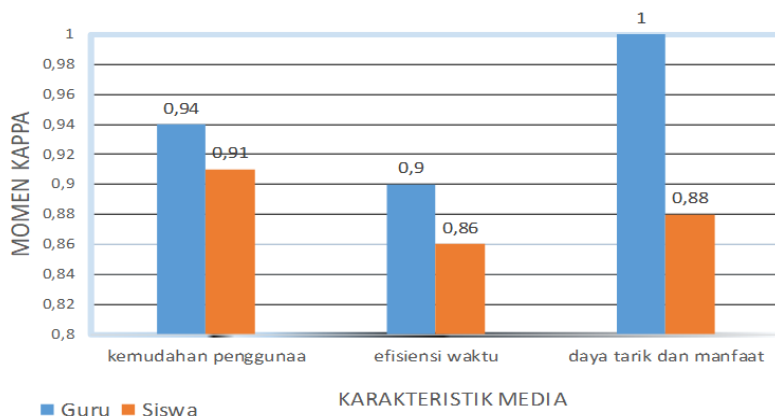


Figure 5. Results of analysis of teacher and student practicality tests for chemistry comics on Electrolyte and Non-Electrolyte Solution material; Media Characteristics of Kappa Moments

## DISCUSSION

### 1. Define

In the define stage, identification and analysis of problems are carried out in the form of front end analysis, student analysis, task analysis and concept analysis. The results obtained from this stage of defining are found problems that require the development of an alternative learning media in the form of chemistry comics. The comic media was developed in the form of print media. Based on research from Nagata that comic media can help students remember and make it easy to bring back their memories about the material they have learned. [14]

### 2. Design

At the design stage there are several steps that must be done, namely making a cover (front cover), introduction of characters, competencies to be achieved and the story line. Making the cover contains the title of the comic, the agency or related institution, the name of the author, the purpose or target of the book as well as interesting supporting images. Making a character introduction containing pictures

and characters of each character. The next step is creating a competency page to be achieved. This step aims to find out the minimum competency that must be achieved by students and the limits of the material presented in chemistry comics.

The final step is creating a story line. The making of the story line is divided into four stages, namely a story script containing a draft or collection of character dialogues that will become a chemistry comic storyline so that it does not come out of a predetermined theme. Then the initial sketch that contains a rough picture that does not have color. In making the initial sketches must pay attention to the arrangement of panels (frames) between images to be arranged. Next, the process of coloring the comic using the Adobe Photosope CS6 application. The final step, making the conclusion sheet aims to conclude the concepts that have been obtained by students when reading comics. The application used to make this conclusion sheet still uses Adobe Photoshop CS6.

The whole process of making chemistry comics using the Adobe



Photoshop CS6 application, because the application is easy to use, has many color variants, lots of good new features. Not only that, Photoshop can also creates new designs, edit images or manipulate photos.

### 3. Develop

#### a. Validity Test

##### 1) Attention Function

The attention function aims to attract and direct students' attention to be able to concentrate on the content of the lessons related to visual meaning. [7] Based on the results of the analysis of the assessment data by the validator on the attention function of the chemistry comics learning media, the kappa moment value was 0.84 with a very high validity category. This shows that the chemistry comic media as a learning media is able to attract and direct students to be able to concentrate on the learning content of Electrolyte and Non-Electrolyte solutions.

In chemistry comics equipped with comic reading instructions that are easy to understand and the use of language that is not ambiguous and easily understood by readers. Besides the layout of the images and colors in the chemistry comics that were developed were able to attract the attention of students. Because empirically, students prefer books that are illustrated, full of colors and visualized in the form of cartoons so that they can increase student interest in learning better. [6]

The use of writing types and writing sizes in chemistry comics is clearly legible. The types of writing on chemistry comics use Comic Sans MS with writing sizes ranging from 11 and 12 pt. The developed chemistry comics have fulfilled the attention function of a learning media on Electrolyte and Non-Electrolyte Solutions with a very high level of validity.

##### 2) Affective Function

Affective function aims to see the level of student enjoyment in using chemistry comics when studying. [7] Based on the assessment data from the validators on the affective function of learning media in the form of chemistry comics on the material

Electrolyte and Non-Electrolyte obtained kappa moment value of 0.85 with a very high validity category. This shows that stories presented in comic media can attract students 'attention and increase students' enjoyment in reading comics. One of the advantages of comics is that the presentation contains strong visual and story elements. The expressions expressed in the story involve the emotions of the reader so that it makes the reader to continue reading until it's over. [6] Chemical comics developed have fulfilled the affective function of a media so that it can be used as a learning media on Electrolyte and Non-Electrolyte Solution material.

##### 3) Cognitive Function

The cognitive function of visual media to facilitate the achievement of learning objectives. [7] Based on the assessment data from the validators, the cognitive function of chemistry comic media on Electrolyte and Non-Electrolyte solutions as a learning media is obtained moment value of 0.86 with a very high level of validity.

This shows that the chemistry comics arranged in the form of stories can facilitate students in achieving learning objectives, the material in the form of conceptual and procedural knowledge is in accordance with core competencies and basic competencies. The developed chemistry comics are in accordance with the cognitive function of a media so that it can be used as a learning medium on the material Electrolyte and Non-Electrolyte with a very high level of validity.

##### 4) Compensatory Functions

The compensatory function of instructional media is to help students who are weak in accepting learning become easier to understand. [7] Based on the validator's evaluation of the compensatory function of the chemistry comics learning media on the material Electrolyte and Non-Electrolyte obtained kappa moment value of 0.86 with a very high level of validity. This shows that chemistry comics as a learning medium can help students strengthen their understanding of Electrolyte



and Non-Electrolyte Solution material, and help students who are weak in organizing texts then recall them. In line with what Nagata said, that comic media makes students remember easily and bring back their memories about the material they have learned. [14]

Because the information written in the comic media is concise, concise and contained. So that the chemistry comics developed have fulfilled the compensatory function of a media so that it can be used as a learning medium on Electrolyte and Non-Electrolyte solutions with very high levels of validity.

#### **b. Practicality Test**

Determination of the level of practicality to the learning media of comic chemistry on the material Electrolyte and Non-Electrolyte solution was carried out by three chemistry teachers at SMAN 2 Payakumbuh and 27 students of class X MIPA 1 at SMAN 2 Payakumbuh.

The results of the analysis of the practicality of chemistry comics learning media on the material Electrolyte and Non-Electrolyte by the teacher using kappa moments get a value of 0.95 with a very high level of practicality category. While the results of practicality analysis conducted by students using kappa moments get a value of 0.88 with a very high level of practicality. The average value of kappa moments from the results of the analysis of the practicality of chemistry comics learning media on the material Electrolyte and Non-Electrolyte was 0.91 with a very practical category. The practicality assessment of chemistry comics learning media is based on the characteristics of practical media with indicators namely ease of use, time efficiency and attractiveness and benefits.

##### **1) Ease of Use**

The practicality of chemistry comics learning media on Electrolyte and Non-Electrolyte Solutions, for indicators of ease of use get kappa moment values from teachers and students respectively of 0.94 and 0.91 with very high levels of practicality. This shows that the chemistry

comic media developed has fulfilled one characteristic of practical media, namely ease of use. Chemical comics as a learning media on the material Electrolyte and Non-Electrolyte have clear usage instructions, the language used is easy to understand, the storyline is made easy to understand and invites students to link concepts to the material in daily life, and the delivery of material which is easily understood by students. In addition, the developed chemistry comic media can increase student motivation in learning and the learning process becomes more enjoyable. In line with Sudjana's opinion, that comic books can be used effectively by teachers in an effort to increase students' interest in reading and learning and to expand vocabulary. [19]

##### **2) Time Efficiency**

Practicality of Chemical Comics as a learning media on the material Electrolyte and Non-Electrolyte on time efficiency, the kappa moment value of practicality of teachers and students is 0.9 and 0.86 with very high level of practicality. Chemical comics on the material Electrolyte and Non-Electrolyte can be used repeatedly by students, not only during class hours but also outside of class hours. Chemical comics developed can save student learning time to be more effective and efficient.

##### **3) Attractiveness and Benefits**

Practicality of Chemical Comics as a learning media on the material Electrolyte and Non-Electrolyte about the attractiveness and benefits obtained kappa moment values of practicality of teachers and students of 1 and 0.88 with very high levels of practice. Chemical comics on the material Electrolyte and Non-Electrolyte solutions developed can help improve students' thinking abilities, help improve memory, increase interest in learning and can help facilitate independent learning.

## **CONCLUSION**

Based on the results of research that has been done, it can be concluded as follows,

1. Chemical comics on the material Electrolyte and Non-Electrolyte can be made and produced so that it can be used as an alternative learning medium for Class X SMA.
2. Learning media in the form of chemistry comics on Electrolyte and Non-Electrolyte Solutions for Class X SMA developed, based on the media function has a very high level of validity with a kappa moment value of 0.85 and based on the characteristics of the media has a very high level of practicality with the kappa moment value of practicality of teachers and students are respectively 0.95 and 0.88.

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### REFERENCES

1. Permendikbud No. 37 Tahun 2018. Perubahan Atas Peraturan Menteri Pendidikan dan Kebudayaan Nomor 24 Tahun 2016 Tentang Kompetensi Inti dan Kompetensi Dasar Pelajaran Pada Kurikulum 2013 Pada Pendidikan Dasar dan Pendidikan Menengah. In: revisi 201. Jakarta; 2018. p. 65–70.
2. Budiarti WN, Haryanto H. Pengembangan Media Komik Untuk Meningkatkan Motivasi Belajar Dan Keterampilan Membaca Pemahaman Siswa Kelas Iv. J Prima Edukasia. 2016;4(2):233.
3. Novianti. Pengembangan Media Komik Pembelajaran Matematika untuk Meningkatkan Pemahaman Bentuk Soal Cerita Bab Pecahan Pada Siswa Kelas V SDN Ngembung. J Mhs Teknol Pendidik. 2010;1:1–12.
4. Sadiman. Media Pendidikan : Pengembangan dan Pemanfaatannya. Jakarta: PT. Raja Grafindo Persada; 2014.
5. Santyasa IW. Landasan Konseptual Media Pembelajaran. J Dep Phys Educ. 2007;1–23.
6. Daryanto. Media Pembelajaran. Yogyakarta: Gava Media; 2016.
7. Arsyad A. Media Pembelajaran. Jakarta: Raja Grafindo Persada; 2015.
8. M.S Gumelar. Comic Making- Cara Membuat Komik. Jakarta: Indeks; 2011.
9. McCloud S. Understanding Comic: The Invisible Art. New York City: HarperCollins Publisher, Inc.; 1993.
10. Lestari DI, Projosantoso AK. Pengembangan media komik IPA model PBL untuk meningkatkan kemampuan berfikir analitis dan sikap ilmiah. J Inov Pendidik IPA. 2016;2(2):145.
11. Zulkifli. Pengaruh Media Komik Terhadap Hasil Belajar Kimia Pada Konsep Reaksi Redoks. Universitas Islam Negeri Syarif Hidayatullah; 2010.
12. Rota G. “Comics” as a tool for teaching biotechnology in primary schools. Electron J Biotechnol. 2003;6(2):8–12.
13. Tiara A. Pembuatan Komik Berwarna Pada Materi Zat dan Karakteristiknya untuk Kelas VII SMP/MTs. J RES IDU. 2019;3(14):155–64.
14. Nagata R. Learning biochemistry through manga - Helping students learn and remember, and making lectures more exciting. Biochem Educ. 1999;27(4):200–3.
15. Fawaidah H. Media Pembelajaran CHEMIC ( Chemistry Comic ) Pada Materi Ikatan Kimia Untuk Siswa Kelas X. Unesa J Chem Educ. 2016;5(3):621–8.
16. Sugiyono. Metode Penelitian Kualitatif Kuantitatif dan R&D. Bandung: Alfabeta; 2017.
17. Trianto. Mendesain Model Pembelajaran Inovatif-Progresif. Jakarta: PT. Fajar Interpratama Mandiri; 2009.
18. Boslaugh. Statistics in a Nutshell: a Desktop Quick Reference. Sebastopol, CA: O’Reilly Media Inc; 2008.
19. Sudjana, N., & Ahmad Rivai A. Media Pengajaran. Bandung: Sinar Baru Algesindo; 2011.

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