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Response to Video Experiments on Identification of Electrolyte and Non-Electrolyte Solutions with Easy, Cheap, and Environmentally Friendly Methods, Tools, and Materials Through Online Media

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Abstract: **During a pandemic like this, face-to-face learning is being transferred directly to online learning**. Experiments with electrolyte and non-electrolyte solutions require student activity to achieve learning objectives, so an innovative and effective method and media are needed. The purpose of this study was to find out how the response of video viewers that had been distributed through YouTube media, both in terms of quality, methods, materials, and chemical content discussed. The research method is by surveying the opinions (responses) of the audience who watched the video, then described qualitatively with graphic data from the response results as support. From the results of the video publication, it was obtained how the response was obtained statistically, and then the statistical data was analyzed based on the average response of each question. It was found that most of the audience agreed on the quality, easy application of the method, cheap materials, and the concept of electrolyte solution being discussed. It was concluded that the experimental media with video in this study could be a solution for teachers to keep teaching their students by practicing independently at home with the video content in this study as a guide.

Keywords: Electrolyte, non-electrolyte, environmentally practicum, easy experiment

*Abstrak: **Pada masa pandemik seperti ini, pembelajaran tatap muka secara langsung dialihkan menjadi pembelajaran daring**. Percobaan larutan elektrolit dan non elektrolit membutuhkan keaktifan dari siswa untuk mencapai tujuan pembelajaran, sehingga dibutuhkan suatu inovasi metode maupun media yang efektif dan mendukung. Tujuan dari penelitian ini adalah untuk mengetahui bagaimana respon penonton video yang sudah disebarkan melalui media Youtube, baik dari kualitas, metode, bahan, serta konten kimia yang dibahas. Metode penelitian dengan cara survey pendapat (respon) dari para audiens yang menonton video, lalu dideskripsikan secara kualitatif dengan data grafik hasil respon sebagai pendukung. Dari hasil publikasi video diperoleh bagaimana respon yang didapat secara statistik, selanjutnya data statistik dianalisis berdasarkan rata-rata respon dari setiap pertanyaan. Diperoleh hasil bahwa sebagian besar penonton setuju akan kualitas, penerapan metode yang mudah, bahan yang murah, dan konsep larutan elektrolit yang dibahas. Disimpulkan bahwa media percobaan dengan video di penelitian ini dapat menjadi salah satu solusi bagi para guru untuk tetap mengajarkan siswa-siswanya dengan cara praktikum secara mandiri di rumah dengan isi video di penelitian ini sebagai pedomannya.*

***Kata kunci** : Elektrolit, non-elektrolit, percobaan ramah lingkungan, percobaan sederhana*

▪ INTRODUCTION

Chemical bonding is a subject that students must understand at the high school level. The subject cannot be separated from the concepts of covalent bonds (Ayral & Molvinger, 2020) and ionic bonds (Pazinato, Bernardi, Miranda, & Braibante, 2021). Students cannot directly understand ionic bonds and covalent bonds if they only use classical learning with the lecture method in the class (Mancheño et al., 2019). Experiments are needed as a medium for learning about the concept of chemical compounds with types of covalent bonds and ionic bonds (Saar et al., 2020). Compounds with covalent bonds and ionic bonds can be identified through the characteristics in the form of the solution. A solution containing a compound with covalent bonds, then the molecules in the solution will be in the form of the initial compound, i.e., covalent compounds, such as sugar, if dissolved in water, will remain with the condition of the sugar molecules. In contrast to a solution containing salt, ions of the salt-forming components will be formed. Both can be detected by identifying electrolyte and non-electrolyte solutions (Guo et al., 2019).

Experiments on electrolyte and nonelectrolyte solutions have been carried out in the laboratory using readily available chemicals. Materials used include non-organic compounds for nonelectrolyte solutions and acidic or basic compounds for electrolyte solutions (can conduct electricity) (Nurrohmah, Supriatna, Fatimah, & Setiaji, 2020). However, with the current pandemic, face-to-face learning has turned into distance learning. Distance learning is not only implemented in theoretical learning (Ramachandran & Rodriguez, 2020) and chemistry experiments because neither teachers nor students can do it (Rodríguez Núñez & Leeuwner, 2020). So that some teachers work around this with online practicums (Pei & Wu, 2019), where students are given a practicum video (Petillion & McNeil, 2020), and then they make reports from home (Saar et al., 2020). Practicum is one of the media where students can explore skills in carrying out practicum (Kamilah, ., Nizar, & Kurniawati, 2020). These practical skills cannot be achieved with online practicums. From the problems above, other methods are needed to carry out practicum still, and teachers can teach optimally even without face to face; of course, the learning objectives will still be achieved very well.

This study aims to provide the best choice for chemistry teachers, especially in teaching the concept of compounds with covalent bonds and ionic bonds, through experiments to identify electrolyte and non-electrolyte solutions with a series of simple tools and materials that are easy, inexpensive, and environmentally friendly (Graham, Jones, Schaller, & McIntee, 2014). So that students can do it independently from home. Furthermore, the researchers tried to find responses related to the videos made by the respondents who had watched the videos in this study.

▪ METHOD

This research method applies survey methods and qualitative descriptions (Creswell, 2012). Research implementation activities include:

a. Method

Making a practical demonstration video of electrolyte and non-electrolyte solutions. The making of the video begins with preparing the practical implementation to test the electrolyte properties of several solutions; of course, it is preceded by designing a simple tool as a detector of electrolyte and non-electrolyte solutions. The videos that

have been made are then rearranged by providing additional effects in the form of sound, images, and text to increase the attractiveness of the video. The preparation of videos using the *kinemaster* application is intended for the audience who will imitate the experiment with video media to use easy-to-obtain and understand applications easily.

Publication of videos through online media

The video is edited in such a way according to the target expected by the researcher. Furthermore, the video is uploaded via online media. Researchers chose *youtube* to publish videos that have been made to make it easier to watch in general and easy to share the address (link) of the video with the respondents to be addressed.

Dissemination of videos and questionnaires through online media

The researcher tried to share the youtube link from the uploaded video and the google form link to comment on the audience for this electrolyte solution practicum video. The distribution of links is carried out in various online media, both from social media groups among students, teachers, and high school students. The questionnaire did not ask for the respondent's name or status to allow the respondents to respond honestly without worrying about their identity information.

b. Respondent

Respondents are prospective chemistry teacher candidates, 22 respondents willing to give their comments, even though the video has been watched more than 80 times on the youtube page.

c. Instrument

Questionnaire video practicum electrolyte and non-electrolyte solution

The next step is the researcher prepares a response questionnaire from the video viewers (Yani, Mawardi, & Azra, 2019). The response questionnaire is then analyzed to find out the response from the audience regarding the video that has been published (Hadinugrahaningsih, Andina, Munggaran, & Rahmawati, 2020). An expert who has validated the questionnaire, in this case, is the supervisor. The questionnaire contains a Likert scale from 1 for the least close to 5, which is the closest. The questionnaire consists of; 1) a complete discussion of the theme, 2) an environmentally friendly experiment, 3) an experiment that is easy to do/imitate, 4) an experiment with the use of tools and materials that are cheap and easy to obtain, 5) the attractiveness of the video to watch, 6) the feasibility of being used as learning media, 7) innovative content, and 8) content that can make it easier to understand chemical concepts.

d. Research findings data processing

The questionnaire results from the respondents were then recapitulated in the form of graphs and analyzed based on the existing response values.

▪ RESULT AND DISCUSSION

Description of video content

This study's experimental video on electrolyte and non-electrolyte solutions aims to enable students to classify solutions into electrolyte and non-electrolyte solutions based on their electrical conductivity. This practicum uses environmentally friendly materials because it can use used goods and uses simple tools so that it is suitable for use during distance learning. The materials used are simple, so this practicum requires relatively low costs. The video contains several stages. Here are pictures of the experimental stages contained in the video:

a. Set of tools

Tools used to make electrolyte test kits include led lights, cables, electrodes, and batteries. Two batteries are connected so that they have an ample volt to turn on the lights. Then the battery is connected to the electrodes and led lights using cables. Figure 1 is a tool for identifying electrolyte and non-electrolyte solutions:

Figure 1. A series of identification tools for electrolyte and non-electrolyte solutions

b. Identification Electrolyte and Non-Electrolyte Solution

The electrolyte test equipment that has been assembled is then used to test the sample solution. The sample solution to be tested is put into a glass. The test is carried out by inserting the electrode into a glass that already contains a sample solution. Tests carried out in several sample solutions include:

Identification in sugar solution

The results obtained that the lamp does not turn on and there are no bubbles (Figure 2). There is no light because sugar is a non-polar covalent compound. So that in solution, the sugar does not break down into ions but remains in the form of molecules. Sugar solutions are organic molecules. The absence of gas bubbles because in the sugar solution there is no electrolysis process. The electrolysis process produces gas bubbles. The experimental results show that the sugar solution is a non-electrolyte solution.

Figure 2. Identification in sugar solutions

Identification in packaged solutions

The results are bright lights and lots of bubbles. A bright light occurs because this solution is a packaged drink that contains ions so that in the solution, a perfect ionization process occurs, producing an electric current. The appearance of gas bubbles indicates the occurrence of an electrolysis process. If an electric current is applied to the electrolyte solution, an electrolysis process produces gas bubbles. The results showed that the *pocari sweat* solution was a strong electrolyte solution.

Figure 3. Identification in packaged solutions

Identification in mineral water

The results of the lights are dim with a few bubbles. Water is a polar covalent compound, so the light is dim due to partial ionization. Gas bubbles may appear even slightly because the solution is a polar covalent compound. The results of the study indicate that mineral water is a weak electrolyte solution.

Figure 4. Identification in mineral water

Identification in soda solution from packaged drinks

The results of the lamp are bright with lots of bubbles on the electrodes. The light is bright because there is complete ionization in the soda solution from this packaged drink. When an electric current flows through the electrolyte solution, it will cause gas bubbles, an electrolysis process. The experimental results show that the *sprite* solution is a strong electrolyte solution.

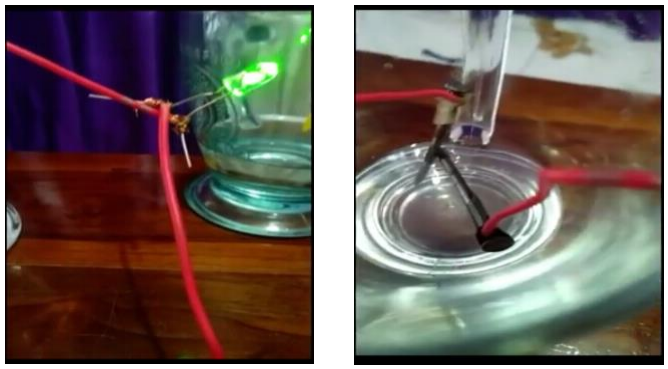

Figure 5. Identification in soda solution from packaged drinks

Identification in soda solution from packaged beverage powder

It was found that the light did not turn on, and there were a few bubbles. The light does not occur because there is no ionization process in the soda solution from the packaged beverage powder. When flowing in *adem sari* solution, electric current will cause gas bubbles, which indicates that the *adem sari* solution is a weak electrolyte.

Figure 6. Identification in soda solution from packaged beverage powder

Questionnaire data

After the distribution of the experimental video, the researcher then recapitulates the questionnaire from the questionnaire results that have watched the video content. The following are the results of the questionnaire from 22 respondents:

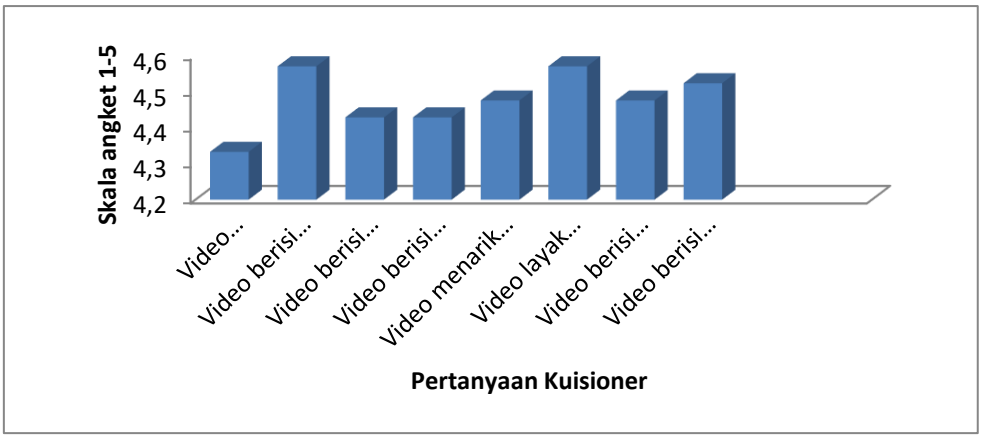

Figure 7. Questionnaire data graph

Questionnaire 1. The video discusses the theme in full

The video presented discusses the incomplete theme. The complete theme should include macroscopic, submicroscopic, and symbolic representations of electrolyte and non-electrolyte solutions. The video presented has not discussed symbolic representation. The symbolic representation in electrolyte and non-electrolyte solutions includes the reaction equations that occur in each test. Chemistry includes three representations : macroscopic, symbolic and submicroscopic (Laliyo, Tangio, Sumintono, Jahja, & Panigoro, 2020).

Questionnaire 2. Environmentally friendly experiment

The video presented already discusses an environmentally friendly experiment. Environmental problems make scientists think about doing environmentally friendly experiments (Al-Idrus, Hadisaputra, & Junaidi, 2020). So that the green chemistry approach is currently very widely used the approach may include the reduction of

materials that can harm the environment. This reduction can be circumvented by replacing hazardous practicum materials using materials that are more environmentally friendly.

Questionnaire 3. The video contains experiments that are easy to do

The electrolyte and non-electrolyte solution experiments that have been presented contain experiments that are easy to do. Experiments are suitable for distance learning with direction from the teacher because they are easy to imitate. According to (Taufik, 2019) education in the future tends to be distance learning conducted online. So it is necessary to hold breakthroughs such as conducting independent practicum from home with easy experiments. This new breakthrough makes it easier for students to do independent practicum from home.

Questionnaire 4. Experiment using tools and materials that are cheap and readily available

Experiments carried out using materials and tools are relatively inexpensive, so it does not require a large enough cost. Materials are readily available so that experiments can be carried out anywhere. Practicum using tools and materials that are cheap and readily available does not eliminate the existence of electrolyte nonelectrolyte solution practicum because it can still be used to distinguish between the electrolyte and nonelectrolyte solutions (Mastura, Mauliza, & Nurhafidhah, 2017).

Questionnaire 5. Interesting videos to watch

The process of making videos includes the editing process. The editing process aims to make the videos that are made more exciting and not dull. With interesting videos, students will be more comfortable learning. One of the principles in media development is that the media used can attract students' interest in learning (Yuniati, Purnama, & Nugroho, 2017). The higher students' interest in understanding material will make it easier to understand the electrolyte solution material.

Questionnaire 6. Video is suitable for use as a learning medium

The video is feasible because it meets the principles in developing media, including being easy to see, interesting, uncomplicated, valid, logical, and structured (Nurseto, 2011). The better the media, the more appropriate the media is used in the learning process. The media serves as a tool or bridge that leads to an understanding of the material (Maulana, 2017).

Questionnaire 7. Videos contain innovative content

The content in the video is innovative. The video contains experiments that have not been performed before. The existence of innovative media makes students not bored with the media used, so that students are increasingly curious about the electrolyte solution material experiment. In addition, the content of the material in the video is also following the learning objectives to be achieved. Chemistry teachers are required to innovate in the media used continuously. Good learning strategies can be achieved with appropriate updates in learning media (Lubis & Ikhsan, 2015).

Questionnaire 8. Videos contain content that can make it easier to understand chemical content

Videos contain easy-to-understand content because sub-microscopic and macroscopic representations have been delivered, although the symbolic representations have not been delivered perfectly (Wang, Chi, Luo, Yang, & Huang, 2017). With the delivery of the representation, the delivery of the electrolyte solution material has been appropriately conveyed. The easy understanding of the electrolyte material means that the media developed is quite successful. With an easier understanding, the quality of education will increase to maximize student learning outcomes (Cahyati, 2015).

▪ CONCLUSION

Based on the research and discussion results, it can be concluded that the experimental video identification of electrolyte and non-electrolyte solutions with easy, inexpensive, and environmentally friendly methods, tools, and materials through online media can be used by teachers as a new practical breakthrough in distance learning. This is evidenced from the results of the questionnaire as follows: the video discusses the theme in full 4.33; environmentally friendly experiment 4.57; videos of easy-to-do experiments 4.43; experiments using tools and materials that are cheap and readily available 4.42; exciting videos to watch 4.48; video is suitable to be used as a learning media 4.57; videos containing innovative content 4.4; the video contains content that can make it easier to understand chemical content 4.52. This video media still has the drawback that the video content has not presented a symbolic representation of the electrolyte and non-electrolyte solution material.

REFERENCES

Al-Idrus, S. W., Hadisaputra, S., & Junaidi, E. (2020). Green Chemistry Approach in Environmental Chemistry Practicum Module to Increase the Creativity of Chemistry Teacher Candidates. *Chemistry Education Practice*, *3*(2), 69. https://doi.org/10.29303/cep.v3i2.2110

Ayral, R., & Molvinger, K. (2020). Using Games to Build and Improve 10th Grade Students ' Understanding of the Concept of Chemical Bonding and the Representation of Molecules¨. *Chemical Education*. https://doi.org/10.1021/acs.jchemed.0c01287

Cahyati, K. T. (2015). Peningkatan Minat Dan Pemahaman Siswa Terhadap Materi Layanan Penguasaan Konten Melalui Metode Permainan Di Smp Negeri 1 Prembun Kabupaten Kebumen. *Jurnal Ilmu Pendidikan, Psikologi, Bimbingan Dan Konseling*, *5*(2).

Creswell, J. W. (2012). Educational research: Planning, conducting, and evaluating quantitative and qualitative research. In *Educational Research* (Vol. 4). New York: Pearson. https://doi.org/10.1017/CBO9781107415324.004

Graham, K. J., Jones, T. N., Schaller, C. P., & McIntee, E. J. (2014). Implementing a student-designed green chemistry laboratory project in organic chemistry. *Journal of Chemical Education*, *91*(11), 1895–1900. https://doi.org/10.1021/ed5000394

Guo, F., Hase, W., Ozaki, Y., Konno, Y., Inatsuki, M., Nishimura, K., … Fujita, O. (2019). Experimental study on flammability limits of electrolyte solvents in lithium-

ion batteries using a wick combustion method. *Experimental Thermal and Fluid Science*, *109*(June), 109858. https://doi.org/10.1016/j.expthermflusci.2019.109858

Hadinugrahaningsih, T., Andina, R. E., Munggaran, L. R., & Rahmawati, Y. (2020). Analysis of students' alternative conceptions about electrolyte and non-electrolyte solutions using a two-tier diagnostic test for chemistry teaching improvement. *Universal Journal of Educational Research*, *8*(5), 1926–1934. https://doi.org/10.13189/ujer.2020.080529

Kamilah, S., . H., Nizar, U. K., & Kurniawati, D. (2020). Development of Guided Inquiry Learning Module using Promting Probing Technique in Electrolyte and Non-Electrolyte Solution to Increase Thingking Ability Critical Participant in Class X in Senior High School. *International Journal of Innovative Science and Research Technology*, *5*(8), 75–83. https://doi.org/10.38124/ijisrt20aug139

Laliyo, L. A. R., Tangio, J. S., Sumintono, B., Jahja, M., & Panigoro, C. (2020). Analytic approach of response pattern of diagnostic test items in evaluating students' conceptual understanding of characteristics of particle of matter. *Journal of Baltic Science Education*, *19*(5), 824–841. https://doi.org/10.33225/jbse/20.19.824

Lubis, I. R., & Ikhsan, J. (2015). Pengembangan Media Pembelajaran Kimia Berbasis Android Untuk Meningkatkan Motivasi Belajar Dan Prestasi Kognitif Peserta Didik Sma. *Jurnal Inovasi Pendidikan IPA*, *1*(2), 191. https://doi.org/10.21831/jipi.v1i2.7504

Mancheño, M. J., Royuela, S., De La Peña, A., Ramos, M., Zamora, F., & Segura, J. L. (2019). Introduction to Covalent Organic Frameworks: An Advanced Organic Chemistry Experiment. *Journal of Chemical Education*, *96*(8), 1745–1751. https://doi.org/10.1021/acs.jchemed.8b00810

Mastura, M., Mauliza, M., & Nurhafidhah, N. (2017). Natural Material-Based Chemistry Practicum Guide Design. *JIPI (Jurnal IPA & Pembelajaran IPA)*, *1*(2), 203–212.

Maulana, M. A. (2017). *Pengembangan media pembelajaran berbasis leaflet pada materi sistem sirkulasi kelas XI Man I Makassar*. Universitas Islam Negeri Alauddin Makassar.

Nurrohmah, S., Supriatna, A., Fatimah, S. S., & Setiaji, B. (2020). The application of scaffolding augmented reality (AR) media in the sharing task learning of electrolyte and non-electrolyte solutions. *Journal of Physics: Conference Series*, *1521*(4). https://doi.org/10.1088/1742-6596/1521/4/042064

Nurseto, T. (2011). Membuat Media Pembelajaran yang Menarik – Tejo Nurseto. *Ekonomi Dan Pendidikan*, *8*(1), 19–35.

Pazinato, M. S., Bernardi, F. M., Miranda, A. C. G., & Braibante, M. E. F. (2021). Epistemological Profile of Chemical Bonding: Evaluation of Knowledge Construction in High School. *Journal of Chemical Education*, *98*(2), 307–318. https://doi.org/10.1021/acs.jchemed.0c00353

Pei, L., & Wu, H. (2019). Does online learning work better than offline learning in undergraduate medical education? A systematic review and meta-analysis. *Medical Education Online*, *24*(1). https://doi.org/10.1080/10872981.2019.1666538

Petillion, R. J., & McNeil, W. S. (2020). Johnstone's Triangle as a Pedagogical Framework for Flipped-Class Instructional Videos in Introductory Chemistry. *Journal of Chemical Education*, *97*(6), 1536–1542. https://doi.org/10.1021/acs.jchemed.9b01105

Ramachandran, R., & Rodriguez, M. C. (2020). Student Perspectives on Remote Learning in a Large Organic Chemistry Lecture Course. *Journal of Chemical Education*,

97(9), 2565–2572. https://doi.org/10.1021/acs.jchemed.0c00572

Rodríguez Núñez, J., & Leeuwner, J. (2020). Changing Courses in Midstream: COVID-19 and the Transition to Online Delivery in Two Undergraduate Chemistry Courses. *Journal of Chemical Education*, *97*(9), 2819–2824.

Saar, A., McLaughlin, M., Barlow, R., Goetz, J., Adediran, S. A., & Gupta, A. (2020). Incorporating literature into an organic chemistry laboratory class: Translating lab activities online and encouraging the development of writing and presentation skills. *Journal of Chemical Education*, *97*(9), 3223–3229. https://doi.org/10.1021/acs.jchemed.0c00727

Taufik, A. (2019). Perspectives on the Development of the Distance Learning System in Kutai Kartanegara Regency, East Kalimantan. *Jurnal Pendidikan&Konseptual*, *3*(2), 88–98. https://doi.org/DOI:http://doi.org/10.28926/riset_konseptual.v2i4.111

Wang, Z., Chi, S., Luo, M., Yang, Y., & Huang, M. (2017). Development of an instrument to evaluate high school students' chemical symbol representation abilities. *Chemistry Education Research and Practice*, *18*(4), 875–892. https://doi.org/10.1039/c7rp00079k

Yani, F. H., Mawardi, & Azra, F. (2019). Development of student worksheet with class and laboratory activity based on guided inquiry in electrolyte and nonectrolyte solution materials. *Journal of Physics: Conference Series*, *1317*(1). https://doi.org/10.1088/1742-6596/1317/1/012153

Yuniati, N., Purnama, B. E., & Nugroho, G. K. (2017). Pembuatan Media Pembelajaran Interaktif Ilmu Pengetahuan Alam Pada Sekolah Dasar Negeri Kroyo 1 Sragen. *Speed-Sentra Penelitian Engineering Dan Edukasi*, *3*(4).