JPPIPA 9(2) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Development of a Chemo-Entrepreneurship Practicum Video to Improve Material Understanding of Colligative Properties for Senior High School

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Received: March 23, 2022
Revised: December 18, 2022
Accepted: February 25, 2023
Published: February 28, 2023

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DOI: 10.29303/jppipa.v9i2.1512

Abstract: In the era of the industrial revolution 4.0, soft skill development practicum, entrepreneurship, and mastery of material concepts are all critical components in meeting challenges. By incorporating entrepreneurial aspects into practicum, efforts can be made to improve its quality. This research aims to create a practical video with Chemo-entrepreneurship (CEP) on the colligative properties of solutions and evaluate the video quality and student reactions to the product. This study uses a 4D development model to conduct development research (R&D) (Define, Design, Develop, and Disseminate). The product is a chemo-entrepreneurship practicum video in an mp4 that shows making ice cream, soursop syrup, and salted eggs. One material expert lecturer, one media expert lecturer, and four reviewers validate the product. The results of media experts' product quality assessment receive a 95 percent rating in the Very Good category, material experts receive a 90 percent rating in the Very Good category, and senior high school chemistry teachers receive a 95 percent rating in the Very Good category. With a positive response rate of 97 percent, the students were enthusiastic about the video. Based on the evaluation results, it can be concluded that the developed product is suitable for use in the learning process in senior high school on the collaborative properties of solutions to improve entrepreneurship skills and students' understanding.

Keywords: Chemo-entrepreneurship; Colligative Properties of Solutions; Practical Video

Introduction

The era of the industrial revolution 4.0 and economic globalization requires reliable Human Resources and an *entrepreneurial spirit* (Mursalin, 2020). Therefore, education should instill cognitive knowledge and the need to instill adequate knowledge in the form of an entrepreneurial spirit (Harfandi, 2020). Graduates with an entrepreneurial spirit have internalized entrepreneurial values such as innovation, creativity, critical thinking, exploration, communication, independence, and a work ethic (Hamidah & Kamaludin, 2018). It is hoped that high school graduates can become entrepreneurs to reduce unemployment. The Covid-19 pandemic has caused the unemployment rate to increase. According to the Central Statistics Agency (BPS), the 2021 Open Unemployment Rate (TPT) for senior high school graduates increased from 6.69% to 8.55%. Thus, entrepreneurial skills are needed to overcome the problem of unemployment.

The government can make efforts to improve the entrepreneurial skills of high school students through entrepreneurship-based education integrated into all subjects to prepare graduates who are competitive and have high skills and competencies to compete at national, regional, and international levels (Agustina, 2017). Meanwhile, educational institutions also have an essential role in overcoming the lack of entrepreneurial skills of students, namely by; (a) instilling entrepreneurship education in various subjects, teaching materials, extracurricular, and self-development, (b) developing an educational curriculum that provides entrepreneurship education content that can increase understanding of entrepreneurship, cultivate character, and entrepreneurial *skills*, (c) foster culture entrepreneurship in the school environment

How to Cite:
Ni'mah, A., & Kamaludin, A. (2023). Development of a Chemo-Entrepreneurship Practicum Video to Improve Material Understanding of Colligative Properties for Senior High School. *Jurnal Penelitian Pendidikan IPA*, *9*(2), 666–675. https://doi.org/10.29303/jppipa.v9i2.1512

(Isrososiawan, 2013). Thus, the role of the teacher is needed in familiarizing students with various forms of activities to develop or train entrepreneurial skills. However, the reality shows that most teachers in schools have not provided entrepreneurship education content in the learning process (Sisnodo et al., 2015). In addition, the learning process tends to be teacher-centered and less demanding on students' skills (Rahmawanna et al., 2016).

Chemistry is one of the subjects that has many links in everyday life and is close to entrepreneurship (Lelono & Saptorini, 2015). Chemistry learning will be more meaningful if it can be applied in real life (Jannah et al., 2019). One approach to chemistry learning that can be applied and is beneficial for the lives of students is Chemo-entrepreneurship (CEP) (Sustainable, 2019). According to Nugraheni (2016), the CEP approach allows students to learn the process of processing material into a useful product, has economic value, and creates an entrepreneurial spirit. Therefore, the application of CEP in learning is essential to apply. Most students assume that the concepts and principles studied in chemistry have nothing to do with the natural world and have no economic value (Wahyuni & Widiarti, 2010).

According to Kean and Middlecamp (Mentari, 2017), the difficulty in studying chemistry is because most concepts in chemistry tend to be abstract. This abstraction is sometimes difficult to imagine or see by the senses of sight, so chemistry subjects require an analogy depiction directly or through practicum (Suja, 2014). Practicum is an activity that aims to equip students to understand theory and practice (Nisa, 2017). According to Afni Pinastika Dewi (2020), the existence of a practicum can allow students to apply various science skills and improve scientific attitudes to acquire knowledge within themselves. However, in reality, many schools have difficulty carrying out practicals. This is due to the lack of availability of practicum tools and materials (Deswita & Afriyani, 2022), the lack of time required for practicum activities (Hadi et al., 20121), and the absence of laboratory assistants who can assist in the implementation of the practicum (Damayanti et al., 2019). As a result, practicum activities are not carried out even though practicum is very important in strengthening conceptual understanding of the material being studied (Astuti, 2015). Especially during the pandemic, students cannot do practicum properly (Saraswati & Mertayasa, 2020).

One of the chemicals that have many links in entrepreneurship is the colligative nature of solutions. Colligative properties of solutions study microscopic things, such as the effect of solutes on decreasing vapor pressure, increasing boiling point, decreasing freezing point, and osmotic pressure (Herawati et al., 2013). In addition, the colligative property of the solution is abstract, so that it can lead to misconceptions (Winarni & Syahrial, 2016). This is in line with research conducted by Auliyani et al. (2016), which states that in the colligative properties of the solution, as many as 14.81% of students understand the concept, 33.94% of students experience misconceptions, 45.06% of students do not understand the concept, and 5.96% error. Events that are often encountered in everyday life are making ice puter, which involves lowering the freezing point (Triastuti, 2020), and making syrup related to the concept of increasing the boiling point (Astiti et al., 2016). However, most students do not know that the application of colligative properties of solutions can be realized by entrepreneurship (Lestari, 2019). Therefore, learning media is needed to help high school students understand the material.

Learning media is a tool that can help the teaching and learning process so that the meaning of the message conveyed becomes clearer, and learning can be achieved effectively and efficiently (Nurrita, 2018). One form of learning media is a practicum video (Susanto et al., 2017). Practical videos can help students recognize and understand the tools, materials, use of instruments, and procedures for an experiment. In addition, students can also analyze various phenomena that occur during the experiment, such as a change in color, a change in form, the appearance of gas, sediment, and so on in the given video (Saraswati & Mertayasa, 2020). Based on Erniwati et al. (2014), the use of video-based practicum media can improve student learning outcomes, motivate students to enjoy learning more, and help teachers in terms of efficient time in carrying out practical activities.

Developing a practicum video containing Chemo-entrepreneurship (CEP) on colligative properties of solutions aims to increase students' knowledge of solutions and entrepreneurial abilities through making products. In addition, the video developed can be an alternative medium for teachers to explain the benefits of material colligative properties of solutions with phenomena that exist in everyday life so that students learn chemistry more easily.

Method

The research method used is development research (R&D). The development procedure in this study was to adapt the 4-D model in developing audiovisual-based *powtoon* learning media. According to Thiagarajan, the development of this product includes the stages of *define*, *design*, *development*, and *disseminate* (Sugiyono, 2012).

The *define stage* aims to determine and define the needs in the learning process and collect various information related to the product to be developed. The implementation steps of the *define stage* include needing

analysis and curriculum analysis. The *design stage* aims to design a practicum video that will be developed. This stage includes media selection, format selection, reference collection, making *storyboards*, making instruments, making initial designs, and making instruments. The *development stage* aims to produce a revised practicum video based on input from experts.

The assessor subjects in this study were one material expert lecturer, one media expert lecturer, four *reviewers* (senior high school chemistry teachers), and ten senior high school class XII students as responders to the product that had been developed. The types of data used are product validation data and product assessment data. Product validation data is in the form of suggestions, while product assessment data is qualitative and quantitative data. The instruments used in this study include product validation sheets, product quality assessment sheets, and student response sheets. Product quality assessment was carried out using a Likert scale questionnaire sheet, while student responses used a Guttman scale questionnaire sheet.

The data analysis technique of the product quality assessment results is done by changing the qualitative assessment to quantitative (score) based on a Likert scale, as shown in Table 1 (Sugiyono, 2012).

Table 1 . Scoring rules

Information	Score
Very Good	5
Good	4
Enough	3
Less	2
Very Less	1

Next, the validation score is calculated using Equation 1.

$$\bar{X} = \frac{\sum x}{n} \quad (1)$$

Information:

$\bar{X}$ = Average score
X = Total score of each rater
n = Number of raters

The score obtained is then calculated as the average score for each aspect of the assessment, then converted into a qualitative value according to the ideal assessment category as in **Error! Reference source not found.**

Table 2. Ideal assessment criteria

Score Range	Category
Xi + 1.8 SBi < X	Very Good
Xi + 0.6 SBi < X ≤ Xi + 1.8 SBi	Good
Xi – 0.6 SBi < X ≤ Xi + 0.6 SBi	Enough
Xi – 1.8 SBi < X ≤ Xi - 0.6 SBi	Less
X ≤ Xi – 1.80 SBi	Very Less

Analyzing data from student responses is done by converting qualitative data into quantitative data in the form of scores using the *Guttman scale* in Table 3.

Table 3. *Guttman* scale rules

Information	Score
Yes	1
Not	0

Data that has been changed in the form of the next score is the percentage of the ideal product as a whole, and the formula calculates each aspect:

$$\text{Ideal Percentage} = \frac{\text{Score is reached}}{\text{ideal maximum score}} \times 100\% \quad (2)$$

Result and Discussion

The media developed in this research is a video practicum of colligative properties of chemo-entrepreneurship-charged solutions. The *software* used for video editing consists of *Adobe After Effects CC 2018* and *Adobe Premiere Pro CC 2018* combined with *Powtoon animation*. The two applications were chosen because of the excellent level of compatibility between applications. *Adobe After Effects CC 2018* is supported by audio, images, colors, text, transitions, *special effects*, and animations (Maharani & Hotami, 2017). Meanwhile, *Adobe Premiere Pro CC 2018* is used to edit, edit, and assemble data (video, audio, still image) that have been prepared so that they become a complete video (Winarni et al., 2021). Powtoon Web Apps are easy to use, have interesting animation features, and are free (Dewi & Kamaludin, 2022). The animation features provided include handwritten animation, cartoons, transition effects, and ease of use of the timeline (Saputra & Mampouw, 2022). Animation is a learning medium because it can attract students' attention, help explain abstract concepts and improve understanding of the material being studied (Prasetya et al., 2021). Based on the research of Erniwati et al. (2014), the use of video-based practicum media can improve student learning outcomes and motivate students to enjoy learning more. The research model used in this study follows the 4-D model. The stages of the research are as follows:

Define stage

The *definition stage* consists of needs analysis and curriculum analysis. A needs analysis was carried out by conducting interviews with chemistry teachers at SMA Colombo Sleman, MA Ali Maksum Krapyak, and MA Mafaza Bantul. This interview was conducted to discover the problems or obstacles in learning in the classroom. Based on the interview results, obtained

information that learning chemistry in senior high school class XII tends to be teacher-centered. This is due to the much material that the teacher must teach while the available time is limited so that the teacher only focuses on completing the material. As a result, practical activities are not carried out correctly. In addition, the available learning media have not been able to train students' skills. In the curriculum analysis, the researcher analyzes the Core Competencies and Basic Competencies related to the material developed through practicum videos.

Design Stage

The *design stage* includes media selection, format selection, reference collection, *storyboard, instrument*, and initial design. The media chosen in this research is a practicum video. Furthermore, the selection of formats is adjusted to the selected media, namely the chemo-entrepreneurship (CEP) practicum video.

The reference or material developed in this study is the solution's colligative property, which consists of freezing point depression, boiling point elevation, and osmotic pressure. The developed practicum video contains the manufacture of a product related to the colligative properties of the solution, namely the manufacture of ice cream, soursop syrup, and salted eggs. The practicum video explains the material and the *Financial Plan* (budget estimate).

Product creation for chemo-entrepreneurship videos begins with interviews with people who are experts in their fields. Interviews were conducted to find out how to process food or beverages, the capital issued, and the selling price in the market. The method of making ice cream was obtained from interviews with ice cream sellers and direct observations. Making soursop syrup is obtained from youtube. Making salted eggs is obtained from a salted egg seller from the City of Brebes, famous for its salted eggs.

Next, make a storyboard that aims to simplify the video design process developed. In making this practical video, the *software* is used *Adobe After Effects CC* 2018 and *Adobe Premiere Pro CC 2018,* and other supporting devices, namely *Powtoon* and *Camtasia 2019.* The following is the process of making a practical video.

The first stage, preparing video raw media and materials for freezing point depression, boiling point elevation, and osmotic pressure, will be delivered in the video. The second stage, editing using *Adobe Premiere Pro CC* 2018, can be seen in Figure 1.

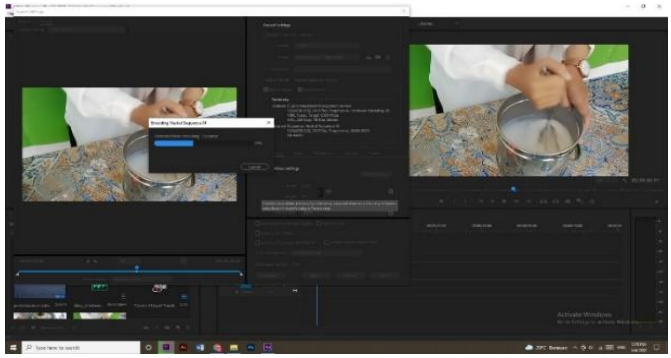

Figure 1. Video editing process in *Adobe Premiere Pro CC 2018*

This stage is done by cutting and speeding up or slowing down the *speed* of the video. The second stage is the process of making videos using *Powtoon,* which can be seen in Figure 2.

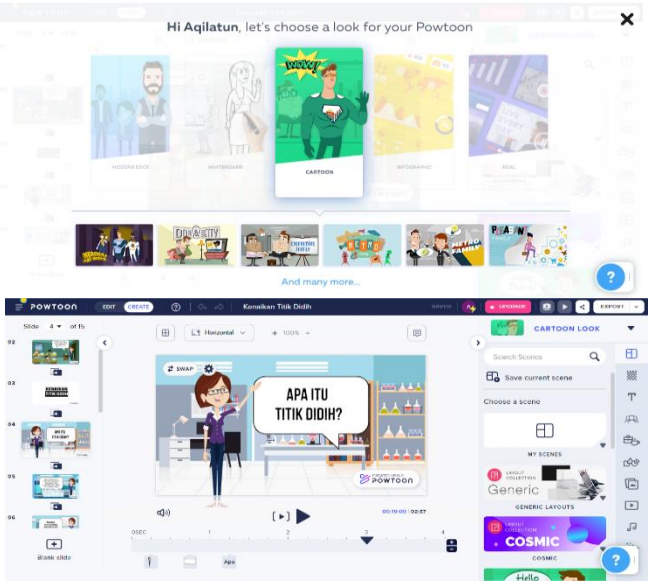

Figure 2. The process of making videos in *powtoon*

The third stage is the *screen recorder* using the Camtasia 2019 application. Camtasia 2019 is used for recording, editing, and publishing videos on the computer screen (Putra, 2017). The *screen recorder process* can be seen in Figure 3.

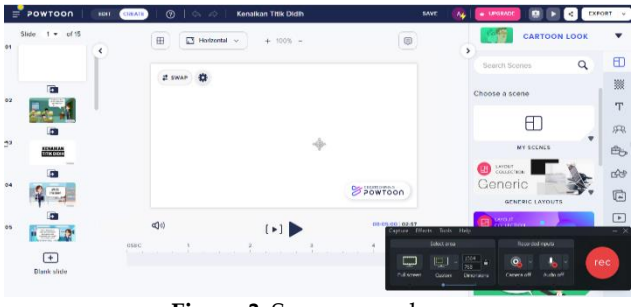

Figure 3. Screen recorder process

The result of the *screen recorder* was then edited using Camtasia 2019. The editing includes adding sound, music, trimming video and audio, and other supporting effects, as shown in Figure 4.

Figure 1. *Screen recorder* video editing process using Camtasia 2019

The fourth stage is making videos in *Adobe After Effects CC 2018*, seen in Figure 5.

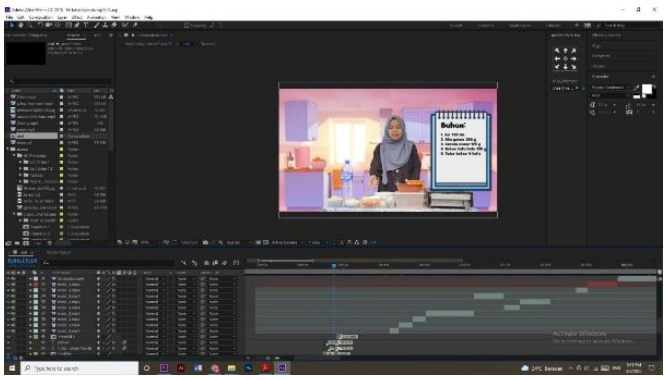

Figure 2. Video creation process in *Adobe After Effects CC 2018*

The last stage is the *finishing stage*. All videos that have been created using *Adobe Premiere Pro CC 2018* and supporting animations using *Powtoon* and Camtasia 2019 are combined using *Adobe After Effects CC 2018*. At this stage, the addition of animation, background, font and color selection, and selection of animation effects is also carried out. The use of effects in *Adobe After Effects* makes the video look more attractive and natural.

The final product of this practicum video is three chemo-entrepreneurship videos on the colligative properties of solutions with a duration of ± 11 minutes each. The components in the developed product consist of *opening*, content, and *closing*. *The opening* is the introduction or initial appearance of the video. *The opening* is made interesting with a mix of effects, writing, and supporting music. The *opening section* contains the *intro*, video title, opening *footage,* and practicum objectives which can be seen in Figure 6.

Figure 6. Video *opening* section

The content section contains two *scans*, namely practicum activities, and discussion. The practicum *scan* consists of two parts, namely tools and practicum materials, and practicum work steps. At the same time, the discussion *scan* consists of a discussion of material and *financial plans, including price estimates, production costs, selling prices, profits, and income,* which can be seen in Figure 7.

Figure 3. Video content section

Closing is the closing part of the video. This section contains closing *footage, quotes*, *credits*, and thanks, as shown in Figure 8.

Figure 8. Video closing section

Furthermore, the making of the instrument is done by making a questionnaire in the form of a *Likert scale* and student response sheets in the form of a *Guttman scale*. This questionnaire contains several aspects that will be assessed by expert lecturers and senior high school chemistry teachers. Meanwhile, the student's response is only a statement that will be answered by the student with a yes or no answer. The instrument is consulted with the supervisor first, then validated by the instrument expert.

***Development* Stage**

After the product's manufacture is complete, the product is validated by media experts and material experts. Media experts play a role in validating media from a video perspective. The results of the quality assessment of the chemo-entrepreneurship practicum video according to media expert lecturers can be seen in Table 4.

Table 4. Product Quality Assessment by Media Experts

No.	Assessment Aspect	Score	Max Score. Ideal	Ideal Percentage (%)	Category
1	Videos	19	20	95.0	Very Good
	Total	19	20	95.0	Very Good

Based on Table 4, it can be concluded that according to media experts, the overall quality aspect of the chemo-entrepreneurship practicum video is on the material colligative properties of the solution obtained a Very Good category with an ideal percentage of 95% and deserves to be used as a student practicum video. This is following research conducted by Putri et al. (2021), who obtained the results of media eligibility by 95% with a very feasible category so that the resulting video media can be used in the learning process.

Material experts play a role in validating media in terms of material and chemo-entrepreneurship. According to material expert lecturers, the quality assessment results of the chemo-entrepreneurship practicum video product can be seen in Table 5.

Table 5. Product Quality Assessment by Material Expert

No.	Assessment Aspect	Score	Max Score. Ideal	Ideal Percentage (%)	Category
1	Theory	9	10	90.0	Very Good
2	CEP Approach	9	10	90.0	Very Good
	Total	18	20	90.0	Very Good

Based on Table 5, it can be concluded that according to experts, the quality of the video practicum contains chemo-entrepreneurship on the material colligative properties of the solution obtained a Very Good category with an ideal percentage of 100% and is suitable for use for practicum in order to improve students' understanding and entrepreneurial abilities. This is following research conducted by Alexander et al. (2018) stated that the video was in the excellent category and suitable for use in learning to improve student understanding.

The chemo-entrepreneurship practicum video that has been validated and revised according to comments and suggestions from experts is then assessed for quality by senior high school chemistry teachers. The teacher's role is to assess the media in material, chemo-entrepreneurship, and video. Four senior high school chemistry teachers carried out the product assessment. According to the reviewers, the following are the results of evaluating the quality of the chemo-entrepreneurship video practicum product, which can be seen in Table 6.

Table 6. Product Quality Assessment by *Reviewers*

No.	Assessment Aspect	Score	Max Score. Ideal	Ideal Percentage (%)	Category
1	Theory	37	40	92.5	Very Good
2	CEP Approach	39	40	97.5	Very Good
3	Videos	76	80	95.0	Very Good
	Total	152	160	95.0	Very Good

Based on Tab el 6, it can be concluded that according to the reviewer, the overall quality of the chemo-entrepreneurship video practicum on the colligative properties of solutions is **Very Good** with an ideal percentage of 95% and is suitable to be used to improve entrepreneurial skills and students' understanding in the material colligative properties of solutions. This is following research conducted by Roesida (2017) obtained an average teacher trial result of 93.09% with

an excellent category so that the resulting video is suitable for use in learning.

The next stage is conducting a limited trial with ten students. Student responses play a role in assessing the media regarding presentation, practicum, chemo-entrepreneurship aspects, understanding the material, and benefits. The following data on student responses to chemo-entrepreneurship practicum videos can be seen in Table 7.

Table 7. Student Responses

No.	Assessment Aspect	Indicator	Score	Max Score. Ideal	Ideal Percentage (%)
1	Presentation	2	18	20	90.0
2	Practice	2	20	20	100.0
3	CEP Approach	2	20	20	100.0
4	Retention of material	2	19	20	95.0
5	Benefit	2	20	20	100.0
Total		10	97	100	97.0

Based on the response results, the percentage of ideality is 97%, so the chemo-entrepreneurship practicum video can improve the understanding of the material and the entrepreneurial spirit of class XII students. This is supported by the results of research conducted by Kanisius Ardiman (2021), which states that the response of students to the use of practicum-based learning video media gets a percentage of 94.75 %, including the excellent category so this learning video media is very suitable to be applied in the learning process.

Conclusion

Based on the research, the results of the practicum video assessment on the colligative properties of Chemo-entrepreneurship (CEP) charged solution by media experts are 95% in the excellent category, material experts are 90% in the excellent category, and *reviewer* obtained the ideal percentage of 95% and excellent category. Furthermore, based on the responses, students got a positive response with a percentage of 97%. The practical video containing chemo-entrepreneurship on the colligative properties of solutions can be used for learning media to increase students' understanding and entrepreneurial spirit.

Acknowledgments

The author would like to thank the supervisors, media experts, material experts, senior high school chemistry teachers, and senior high school class XII students who have contributed during the collection of research data so that this research can be completed. The author also suggests that senior high school chemistry teachers can use chemo-entrepreneurship video practicum on the colligative properties of solutions in the learning process to improve students' understanding of the relationship between colligative properties of solutions in everyday life.

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