# Visualization of the Sampling Method for Quality Control Course in Agroindustrial Products

Dwi Lestari Rahayu*, Siti Afina Sabrina, Puji Rahmawati Nurcahyani

*Agro-industrial Technology Education, Universitas Pendidikan Indonesia,Bandung, Indonesia*
*Corresponding author. Email: dlrahayu@upi.edu*

**ABSTRACT**

Sampling method is one of the materials on the Quality Control (QC) course on agroindustrial products. The sampling method has detailed procedures carried out by sampling officers in the industry. However, this procedure can only be applied to ongoing production process activities. Therefore, students who are studying product sampling methods must look directly at the industry to ascertain how the procedures and equipment are used. To enrich students' understanding of this material, additional explanation in the quality control teaching material is needed. The additional material from the food industry can be presented in various ways, one of which is through learning videos. The purpose of this study was to develop learning media for sampling techniques and to measure students' cognitive learning outcomes after participating in virtual learning with the video. The development of learning videos was carried out using the research and development method, which involves the ADDIE model. The one group pretest posttest experimental design was applied to measure the learning outcomes of experimental class. ADDIE's research begins with an analysis on the development of teaching materials. This was stated by students who had previously studied the QC course. They made some evaluations that learning videos were needed for sampling techniques particularly solid product. This media could help to visualize detailed procedures for taking solid samples on food ingredients and products clearly, so that it is easy-to-understand, and improve the student's learning motivation. The developed learning video includes the explanation of equipment used, timing of sampling, sampling procedure in the black tea production line of PTPN VIII Factory. Learning videos were declared feasible by material validator and learning media validator. The students who had passed the QC course are also declared very feasible. After the ADDIE process, the video was applied for QC course to new students. The learning outcome (cognitive) increased and very satisfying with a moderate N-gain. With video learning media, knowledge transfer activities can be achieved without having to visit the factory to see officers performed the sampling. The development of real industrial visualization can help students have a better understanding even though learning is carried out remotely.

*Keywords: Sampling Technique, Learning Media, Cognitive Learning Outcomes, Video Visualization.*

## 1. INTRODUCTION

Vocational secondary education teachers have the task of carrying out the learning process so that graduates of vocational high schools (SMK) have competencies that are in accordance with what is needed by industry or society. In order for student learning outcomes to be achieved optimally, besides the need for mastery of pedagogic competence, the mastery of professional competence also needs to be owned by the teacher. In article 28 of Government Regulation of the Republic of Indonesia Number 19 of 2005 concerning national education standards, teacher professional competence is defined as mastery of learning material in a broader and deeper manner in order to be able to guide students to meet the competency standards set out in the National Education Standards [1]. In Peraturan Menteri Pendidikan Nasional Republik Indonesia Number 16 of 2007, one of the teacher's professional competencies is demonstrated by mastery of material, structure, concepts, and scientific mindsets that support the subjects taught [2].

Agroindustrial Technology Education as a study program in Indonesia that produces vocational secondary education teacher practitioners in the agribusiness processing of agricultural products equips

students with pedagogical and professional competencies. One of the subjects in the Agroindustry Technology Education study program is quality control which is mandatory for students to follow. In this course, students study the material that supports the professional competence needed by APHP SMK teachers in conducting learning to assess quality in agricultural product production activities. Quality assessment in agricultural product production activities is studied by APHP SMK students in the subjects of processed vegetable, animal, fresh and plantation crops, and spices production.

In assessing the quality of agricultural production activities, adequate knowledge is needed in taking samples of raw materials or products to be tested for quality. Material for sampling raw materials and food products includes material studied by students of Agroindustrial Technology Education. The results of the evaluation of learning activities for the odd semester quality control course for the 2021/2022 academic year show that learning media that can visualize the practice of sampling techniques for materials and food products are urgently needed. The students who had took the course previous thought that the learning resources used in previous lessons in the form of power point slides, SNI documents on sampling techniques and videos available on the internet had not fully helped to provide a complete picture of the practice of material and product sampling techniques in the agricultural product processing industry.

When laboratory facilities for practicing food material and product sampling techniques are inadequate to meet the needs of the students learning, student visits to industry to learn directly how food material and product sampling techniques can be one of the solutions to overcome the learning resource problems. However, carrying out these visits in one semester is also not easy and efficient to do. It is necessary to prepare the visit which cannot be carried out in a short time because it must follow the industrial schedule. The food industry which strictly implements GMP (Good Manufacturing Practices), limits the number of visitors who can enter the production area at one time so that quite a number of industries are needed as destinations for student study visits, while the number of food industries that are not too far away and can be used as places for learning sampling techniques is limited.

To meet the needs of student learning resources described above, the development of learning videos that can provide better visualization of sampling techniques for ingredients and food products in industry is urgently needed. According to Febriani [3], video is considered capable of explaining abstract things to make it look real. The use of video as a learning medium makes it easier for students to learn, remember, and get lessons or material quickly and easily understood [4]. Based on the results of a study by Nootel et al. [5], the use of video in learning in higher education generally shows better learning outcomes for students. Based on this background, learning videos on sampling techniques for food ingredients and products were developed and applied in learning to find out how student learning outcomes after learning using video sampling techniques for solid samples on ingredients and food products are made.

## 2. RESEARCH METHODS

This research is a R&D research using the ADDIE model (analysis, design, development, implementation, and evaluation).

### 2.1. Analysis Stage

At this stage, an analysis of the problems of learning media needs is carried out by students as well as solutions that can be chosen to overcome these problems. A needs analysis was carried out by distributing questionnaires to 62 students from the 2018 and 2019 batches who had taken the quality control course. The questionnaire contains questions about the problems encountered in previous learning and what learning media needed by students. In addition, at this stage, an analysis of the needs needed to develop learning media is also carried out. These needs include the learning material presented in the learning media, the type of learning media to be made, and the equipment needed to make the learning media.

### 2.2. Design Stage

At the design stage, the learning video's flowchart and storyboard were arranged.

### 2.3. Development Stage

At the development stage, learning video was developed according to flowchart and storyboard. The learning video then validated based on expert judgment. After the validation, learning video was revised according to the validator's suggestions. The revised learning video then delivered to student respondents to get their feedback. The student respondents at this stage were the same as the respondents used at the analysis stage, which were 62 students of Agroindustrial Technology Education study program in the 2018 and 2019 batches who had took quality control courses in the previous period and were willing to be respondents in this study.

### 2.4. Implementation Stage

At this stage, the video was tested in online learning activities in July 2022 because it was still Covid-19 pandemic. The learning process is carried out in 2 hours of lessons. Learning begins with a presentation of course topics by the lecturer then students are given a YouTube link to access videos and watch the videos. There are 10 students who take part in this study. They are students from class of 2020 who have not yet signed a contract for quality control courses and are willing to participate in video implementation trial in this study.

## 2.5. Evaluation Stage

The evaluation carried out at this stage is a summative evaluation. Summative evaluation is intended to find out how student learning outcomes are after learning using the learning media that had been made. Learning outcomes were measured using essay type questions. At this stage the resulting video is re-evaluated to identify improvements that are still needed in the video.

The research instrument consisted of learning media validation questionnaires, questionnaires measuring student responses and essay questions. Video validation questionnaires by experts as well as questionnaires measuring the response of video users were prepared referring to Tables 1, 2 and 3. The three questionnaires used a Likert scale assessment (Table 4). Essay test is used to obtain data on student learning outcomes after learning using videos. The test consist of five questions which are arranged according to the learning outcomes indicators as can be seen at Table 5.

**Table 1.** The assessment aspects and indicators used in validation of learning media by learning media expert

| Aspects | Indicators |
|---|---|
| Sound and music | The music does not overlap with the voice of the narration |
| | The clarity of voice narration in video |
| Writing | The suitability of size, font and color of the text |
| | The clarity of the message |
| Colour | The suitability of the use of color in the video (images, text, and background) |
| Video display | The ability of the video to increase the student interest, educate and stimulate students to think |
| | The ease of use of videos |
| | The reliability of the video |

Source: [3][4][5]

**Table 2.** The assessment aspects and indicators used in validation of learning media by learning industry QC practitioner.

| Aspects | Indicators |
|---|---|
| The comprehensiveness of video content | The completeness of course material |

| The accuracy of video content | The accuracy of concept |
|---|---|
| | The accuracy of the use of facts and data |
| | The accuracy of the use of examples and cases |
| | The accuracy of selected picture, diagram, and illustration |
| | The accuracy of the use of terminology |
| The ability to increase student curiosity | The ability to increase student curiosity |
| | The ability to motivate student to dig the information further |
| The relevancy of the video content with the study | The logic, sequence and clarity of the course materials in the video |
| | The relevancy of the video content with student needs |

Source: [5], [6]

**Table 3.** The assessment aspects and indicators in student response questionnaire.

| Aspects | Indicators |
|---|---|
| Video content | The clarity of the course materials in video |
| | The completeness of the course materials in video |
| | The clarity of the language |
| | The suitability of the use of video with the course materials |
| Video Performace | Learning video appearance |
| | The easy of use |
| | The easiness to read the text on video |
| | The font type of the text on video |
| | The color choice |
| | Learning video quality |
| | The sounds on video |
| Usefulness | The usefulness of video as learning source |
| | The ability to increase the student study outcome |
| | The ability to increase the student confidence |
| | The ability to increase student motivation |

Source: [7] with modification

**Table 4.** Likert scale used in questionnaire

| Score | Indicators |
|---|---|
| 1 | Very good |
| 2 | Good |
| 3 | Less |
| 4 | Bad |

Source: [8]

**Table 5.** The summative test indicators

| Learning Outcome | Indicators | The Amount of question | Max. Score |
|---|---|---|---|
| Students are able to apply sample sampling techniques in quality control in agroindustry | Mastery in setting up sampling equipment | 1 | 10 |
| | Mastery in identifying sample sizes in sampling planning | 1 | 10 |

| | | | |
|---|---|---|---|
| | Mastery in mapping sampling points | 1 | 10 |
| | Mastery in carrying out sampling | 1 | 10 |
| | Mastery in packing the samples | 1 | 10 |
| Total | | 5 | 100 |

Data obtained from expert validation and student responses were analyzed to determine the feasibility level of the videos made. The eligibility level refers to Table 6 where the eligibility category is based on the range of eligibility percentages obtained from calculations using the following formula.

$$Percentage\ (\%) = \frac{gain\ score}{max.\ score} x\ 100\%$$

To obtain the value of the pretest and posttest results, the results of assessing student answers are calculated using the following formula.

$$Score = \frac{gain\ score}{Total\ of\ max.\ score} x\ 100$$

The average student score is then calculated to determine the level of the category as shown in Table 7.

**Table 6.** The interpretation of validation percentage value

| Percentage (%) | Interpretation |
|---|---|
| $81.25 \leq$ percentage $\leq 100$ | Very feasible |
| $62.50 \leq$ percentage $< 81.25$ | Feasible |
| $43.75 \leq$ percentage $< 62.50$ | Not feasible |
| $25.00 \leq$ percentage $< 43.75$ | Very inappropriate |

**Table 7.** The category of student cognitive learning outcome

| Average Score | Category |
|---|---|
| $75 \leq$ Score $< 100$ | Very high |
| $50 \leq$ Score $< 75$ | High |
| $25 \leq$ Score $< 50$ | Low |
| Score $\leq 25$ | Very low |

The increase in student learning outcomes is known through the Normalized Gain (N-Gain) test, by looking at the difference in posttest and pretest scores. Calculation of N-Gain posttest results using the following formula.

$$N\text{-}Gain = \frac{posttest\ score - pretest\ score}{maksimum\ score - pretest\ score}$$

The N-Gain calculation results are then interpreted to the category on Table 8.

**Table 8.** The category of N-Gain scale

| N Gain Score | Category |
|---|---|
| N-Gain $\geq 0.70$ | High |
| $0.30 \leq$ N-Gain $< 0.70$ | Medium |
| N-Gain $< 0.30$ | Low |

## 3. RESULTS AND DISCUSSION

The five stages of the ADDIE model can be implemented in this study. At the analysis stage, the results of the problem analysis of media needs needed by students of agroindustrial technology education can be obtained. The learning media previously used in learning in the form of ppt slides displaying pictures and videos available from YouTube and the internet are considered not to have fully visualized the application of sampling techniques for food ingredients and products in the food industry. The results of the questionnaire answers distributed to respondents at the analysis stage showed that most respondents still felt they did not understand, did not remember, and did not understand in detail the sampling techniques applied in the food industry. The limited laboratory facilities of the study program for technical practice of sampling materials and food products make it impossible to carry out practicums on these materials. Therefore, learning media is needed that can help visualize solid sampling techniques for ingredients and food products with clear, easy-to-understand delivery and can increase student motivation in learning the material.

The solution that can be chosen to overcome the problem is learning videos. Questionnaire results data distributed to respondents in the analysis stage showed that as many as 81.7% of students chose learning videos as a type of learning media needed to support learning solids sampling techniques in food ingredients and products. The use of video as a medium of learning in higher education is increasingly common nowadays as stated by Fyfield et al. [9]. According to Winslett [10] video is used in learning because it can present factual, conceptual, or procedural content to students. The results of the study by Ningtyas and Anistyasari [4] state that video as a learning medium helps students more easily learn, remember, and get lessons or material quickly and easily understood.

The learning video designed contains a summary of the material displayed in the animation as well as video examples of the application of sampling techniques in the processed food industry. The learning video was made using Canva video maker application. The sampling technique material shown in the video is focused on selecting samples in the form of solids. Sampling materials for liquid materials are not included in the video because there are quite a lot of video

examples of applications for liquid samples needed and in accordance with the learning objectives that can be found on the internet. An example of the application of the sampling technique in the selected food industry is sampling in black tea production activities at the tea factory of PTPN VIII, Ciater plantation.

At design stage, flowcharts and story boards are arranged as a reference in making learning videos. The researcher designed the material and made the media frame on the flowchart sequentially as a limitation in making learning videos. This is in line with the statement by Agustina et al. [12] that making a flowchart aims to determine the limits of the material to be displayed. In addition, the flowchart is an initial design and reference that serves to illustrate workflow. In Figure 1, the flowchart of the learning material composition in the developed video can be seen.
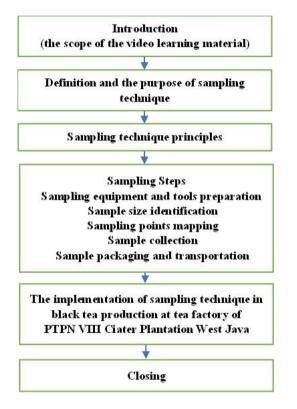


**Figure 1** The flowchart of video content.

The story board or script is arranged in the form of a table which contains the picture design or sentence writing position on the video display as well as the video display position that appears in each scene. In each scene, the narration and sound or background music are written for each scene. The time duration for each scene is planned. This is intended so that the videos produced do not exceed the time limit for effective learning videos. In addition, the narration or speed of the material displayed can be adjusted according to user acceptance. Based on Fisher et al. [13], the rate of speed at which information is presented through visual media can affect the way in which learners engage in the content and process information.

The validation of learning media experts show that the videos made are considered feasible with a percentage value of 73%. However, from the four categories of media evaluation, the aspect of video presentation is considered to still need improvement. Experts provide suggestions for improving the selection of background colors and text that must have more contrast and video image quality. The results of expert validation from the industry show that the learning material in the video is feasible with a percentage value of 77.23%. Experts provide suggestions in the form of correcting the wrong names of production machines and pictures of sampling points that needed to be more clearly.

The videos that have been produced are revised following the suggestions for improving media and material experts. The revised video then sent to the 2018 and 2019 class student respondents to find out how they responded to the videos. The user response shows that the developed video is very feasible with a value of 85%. Some respondents wrote positive responses such as "The learning videos presented are good and the sound explanations are also clear, understandable, and can be used as learning resources". "The learning material displayed is clear, not confusing, and the delivery is not rushed." Even so, there are suggestions in the form of using background colors which are expected to be even more attractive, the completeness of the material presented, such as how to pack the samples that have been taken and adding examples of sampling cases.

At the implementation stage, the videos that have been repaired based on student responses was used in the virtual learning process. The implementation of the video in virtual learning process was carried out in July 2022. The purpose of implementing learning videos in the learning process is to measure student learning outcomes regarding the sampling technique after using the learning videos that have been developed. The implementation process uses a one group pretest-posttest research design.

One day before online learning, the students were asked to do the pretest. Online learning held in two learning hours, started with the explanation by lecturer. Students accessed the learning video after teacher explanation. The students can access the video on https://youtu.be/0Lc9mitherg. At the end of the learning, students were asked by teacher to do the posttest.

The use of sampling technique learning videos in virtual learning shows good results. The average student cognitive learning outcomes were in the very high category (83.9). All of the students' posttest results were in the very high category. The use of video can increase

learning outcomes in the moderate category as indicated by the N-Gain value of 0.49.

The videos developed still have weakness and not all responses from student responses have been implemented. Weaknesses that are still present in the video are the sharpness and clarity of the video image and some text displays that need to be corrected. To produce video quality with excellent image sharpness and clarity, a camera and additional devices that support better lighting are needed, while the camera used in making this video has limited features.

To respond the requests from students who want videos with various examples of the application of sampling techniques in the food industry, they can be fulfilled by making separate videos. The developed learning video has length 15.44 minutes so it is not possible to add content to the video. According to Lagerstrom [14], the maximum duration range of learning videos is 12-20 minutes. Even though the video still needs improvement, the developed learning videos have been able to provide good visualization to students to support the achievement of good learning outcomes.

**Table 9.** Student cognitive learning results

| Score range | Frequency | | Score Range Category |
|---|---|---|---|
| | **Pretest** | **Postest** | |
| $75 \leq$ Score $\leq 100$ | 1 | 10 | Very high |
| $50 \leq$ Score $< 75$ | 6 | 0 | High |
| $25 \leq$ Score $< 50$ | 3 | 0 | Low |
| Score $\leq 25$ | 0 | 0 | Very Low |
| Min. Score | 30 | 76 | |
| Max. Score | 76 | 94 | |
| Average | 56.7 | 83.9 | |

## 4. CONCLUSIONS

The learning video of the sampling technique that has been developed is considered feasible based on learning media assessment criteria and the learning material content. The responses of students indicate that the learning videos developed are stated to be very feasible. The development of real industrial visualization in video learning can help students to have a better understanding on the application of sampling technique. The use of sampling technique learning videos in virtual learning can improve cognitive student learning outcomes.

## AUTHORS' CONTRIBUTIONS

DLR and SAS performed the research. DLR and PRN contributed to manuscript preparation.

## ACKNOWLEDGEMENT

## REFERENCES

[1] Peraturan Pemerintah Republik Indonesia Nomor 19 Tahun 2005 Tentang Standar Nasional Pendidikan

[2] Peraturan Menteri Pendidikan Nasional Republik Indonesia Nomor 16 Tahun 2007 Tentang Standar Kualifikasi Akademik dan Kompetensi Guru

[3] C. Febriani. Pengaruh Media Video terhadap Motivasi Belajar dan Hasil Belajar Kognitif Pembelajaran IPA Kelas V Sekolah Dasar. Jurnal Prima Edukasia, 5(1), 2017, pp. 11–21.

[4] Y. Ningtiyas, Y. Anistyasari. Studi Literatur : Pengaruh Penggunaan Video Sebagai Media Pembelajaran di Perguruan Tinggi. IT-Edu : Jurnal Information Technology and Education, 5(01), 2021, pp. 417-424.

[5] M. Noetel, S. Griffith, O. Delaney, T. Sanders, P. Parker, B. del pozo Cruz, C. Lonsdale. Video Improves Learning in Higher Education: A Systematic Review. Review of Educational Research, 91 (2), 2021, pp.204-236. https://doi.org/10.3102/0034654321990713.

[3] A. A. Anggraeni, M. Nugraheni, T.H. W. Handayani. Pengembangan Video Pembelajaran Mata Kuliah Teknologi Pengawetan Makanan Materi Kacang Disko. Home Economics Journal, 1(1), 2019, pp. 12–20. https://doi.org/10.21831/hej.v1i1.23281

[4] D. N. A. Siahaan. Pengembangan Media Video Animasi dalam Pengenalan Karier Siswa MTs Negeri 2 Medan. 2018.

[5] N. M. Putri, D.P. Parmiti, K. Sudarma. Pengembangan Video Pembelajaran dengan Bahasa Isyarat Berbasis Pendidikan Karakter padaSiswa Kelas V di SDLB-B Negeri I Buleleng Tahun Pelajaran 2017/2018. Jurnal EDUTECH Universitas Pendidikan Ganesha Undiksha, 7(2), 2019,pp. 81–91.

[6] BSNP. Standar Penilaian Buku Teks Pelajaran TIK. BSNP. 2008.

[7] J. Amajida. Pengembangan Media Mobile Learning Berbasis Android pada Materi Himpunan Siswa Kelas VII di MTS NU Hasyim Asy'ari 03 Kudus Tahun Pelajaran 2020/2021. Salatiga: Program Studi Tadris Matematika, Fakultas Tarbiyah dan Ilmu Keguruan (FTIK), Institut Agama Islam Negeri (IAIN) Salatiga. 2020.

[8]  Sugiyono. Metode Penelitian Kuantitatif, Kualitatif, dan R&D. Alfabeta. 2019.

[9]  M. Fyfield, M. Henderson, E. Heinrich, P. Redmond. Videos in higher education: Making the most of a good thing. Australasian Journal of Educational Technology, 35(5), 2019, pp.1-7. https://doi.org/10.14742/ajet.5930

[10] G. Winslet. What counts as educational video?: Working toward best practice alignment between video production approaches and outcomes. Australasian Journal of Educational Technology, 30(5), 2014. https://doi.org/10.14742/ajet.458.

[12] A. Agustina, M. Isnaini, R. S. Nery. Pengembangan Bahan Ajar Matematika Menggunakan Edmodo Pada Materi Fungsi. Jurnal Pendidikan Matematika RAFA, 2(1), 2016, pp.123-141.

[13] S. Fisher, G. Howardson, M. E. Wasserman, K. Orvis. How do learners interact with e-learning? Examining patterns of learner control behaviors. AIS Transactions on Human-Computer Interaction, 9(2), 2017, pp.75–98.

[14] L. Lagerstrom.The myth of the six minute rule: student engagement with online videos. Proceedings of the American Society for Engineering Education, 2015, pp.14-17.

[15] Sugiyono. Metode Penelitian Kuantitatif, Kualitatif, dan R&D. Alfabeta. 2019.