



Development of Excel-Based Practicum Media on Examination of Carbohydrates (Glucose, Sucrose, and Fructose) to Improve Science Process Skills

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Abstract: Science process skills have the potential to build students' basic competencies. There are many factors that influence this skill, one of which is the proper use of media. The development of excel-based practicum media is one of the solutions to solve this problem. The aim of the research is to improve students' science process skills in doing practicum. This study has a Research and Development (R&D) design with a population of 132 people with a sample of 66 people using a purposive sampling technique. includes media feasibility 0.72 or high, visual communication 0.35 or moderate, and material 0.45 or moderate. The reliability test obtained 0.000, which means that the similarity between the ratings given by the two validators is very low. In conclusion, the developed media meets the requirements to be used as a research instrument.

Keywords: Depeloment of Learning Media; Exel-Based Practicum; Science Process Skills

Introduction

Science is knowledge that is obtained in a certain way and is used to gain a deeper understanding of the natural surroundings (Permendikbud, 2014). Science process skills are one of the competencies demanded by 21st century education. Science learning should ideally provide direct experience to students given the importance of these competencies both in lecture activities in class and in the laboratory (Manurung & Sihobing, 2022).

Science process skills have the potential to build basic competence in student life through the gradual development of science skills, scientific attitudes, and knowledge construction processes. So that in the learning process that takes place students master science concepts more than memorizing science concepts,

because in essence if we are more proficient in science concepts students will understand more easily because they have obtained the concept independently through science process skills in proving their curiosity when confronted by lecturers about science-based phenomena (Marta et al, 2018). However, the fact is that currently the science learning process in Aceh is still oriented towards memorizing concepts. So that the science process skills of students are still lacking.

Learning media can also be a tool to clarify the meaning of the message conveyed, so that it can achieve learning objectives better (Sutjipto, 2011). Learning media that have been used before are visual media, audio media, audio visual media and media (Nurdyansyah, 2016).

Based on the results of observations and interviews conducted with students of the Nutrition Department, Poltekkes Aceh in February 2022, information was

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obtained that the practicum for checking carbohydrates could not be carried out optimally, while the practicum tools in the laboratory were sufficient. In the practicum implementation process, students who become practitioners in the laboratory are still unskilled and passive, only carrying out instructions according to the lecturer's directions. From this passive attitude, it can be seen that students still have not applied science process skills during practicum. The passive attitude of students is also caused by the practicum being carried out in groups which causes only a few students to actively participate while the others are just following the practicum and the inefficiency of practicum time due to the pandemic, usually practicum time of 175 minutes/1 credit is now reduced to 100 minutes.

In addition, it can also be seen from the results of the analysis of the practicum value of the food chemistry course for students of the Nutrition Department, the Aceh Health Polytechnic shows an average value of 68.50, it can be seen that there are still students who have not completed their studies. The results of interviews with laboratory instructors said that, during practicums, students only worked on the steps listed in the guide and there were still many students who were not active in doing practicums due to limited time and tools and materials.

During the implementation of the practicum, the delivery of material and practicum steps also seemed monotonous without paying attention to the potential and creativity of students, so that students often felt bored and limited time for carrying out practicums, this made students feel that the time used to carry out practicums was very limited. The obstacles faced by students in carrying out practicums are expected to be overcome by using learning media. Learning Media is a set of auxiliary or complementary tools used by lecturers in order to communicate with students (Damin, 2013).

One of the application programs that can be used to create interactive chemistry learning is excel-based practicum media which explains experimental activities so that it really helps students in terms of time efficiency in carrying out practicum activities and at the same time can improve process skills according to the indicators. SPS can be evaluated starting from how to use the program to evaluation in the form of questions contained in the practicum media program. Using Microsoft Excel-based practicum media as a learning medium can improve understanding of mathematical concepts during the practicum process. Media is also designed interactively that can be used in virtual lab-based learning (Suweken, 2013). Media was also developed using Microsoft Excel software because it has advantages in processing numbers, is easy to program and widely available on every computer (Semadiartha, 2013).

An alternative solution that can be done to improve students' science process skills is by designing excel-based practicum media as learning media. The Excel-based practicum media used is in accordance with SPS achievement indicators which include the skills of observing, classifying, planning experiments, asking questions, asking hypotheses, predicting, using tools and materials, interpreting observations, applying concepts, communicating belonging to the good category designed using Microsoft Excel (Sari et al, 2019). The contents of the Excel-based practicum media are in the form of an introduction and carbohydrate material, a tutorial on examining carbohydrates, and simulation and evaluation. This media display is designed simply so that users can easily use it. Media load menu to see next page and previous page. In addition, this media is equipped with graphs and answer sheets for evaluation. The media used has simulations, graphs, and tables (Nilawati et al, 2015).

UV/Vis spectrophotometric analysis of carbohydrates has been developed by (Makahity & Nazudin, 2019) using the Anthrone method which produces a blue anthrone dye solution with a wavelength of 618-30 nm. However, this method has difficulties in determining the maximum wavelength for excel-based programs, because the maximum wavelengths of each monosaccharide are almost close together, making it difficult to determine the concentration of each monosaccharide. Based on research (Assaker & Rima, 2019) found a new, simpler and more economical method for the determination of glucose, fructose and sucrose in fruit juice by UV/Vis spectrophotometry using Fe reagents and Thiobarbituric acid (BTA). Therefore it is necessary to develop and utilize excel-based learning media in carrying out practicum examination of carbohydrates.

Previous research conducted by (Mustabsyirah, 2017) regarding the development of video-based practicum learning media shows that the research was carried out to improve science process skills in students doing biology labs to make it easier to understand the material and increase student interest in learning.

In this study, the researchers will examine carbohydrates (glucose, sucrose and fructose). The reason researchers took material regarding examining carbohydrates (glucose, sucrose and fructose) was because carbohydrate material is one of the main materials that nutritionists must seriously understand, and they must know the impact of more or less carbohydrate levels consumed by humans, so they can arrange the patient's diet menu according to needs. While the reason researchers use excel-based practicum media is because it has the advantage of increasing understanding of mathematical concepts during the practicum process, so it really helps students in terms of time efficiency in carrying out practicum activities. And

to support government policies during a pandemic and it is hoped that it can provide alternative solutions to direct practicum problems such as time constraints.

Based on the above problems, the researcher is interested in researching related to this problem with the title "Development of Excel-Based Practicum Media on Examination of Carbohydrates (Glucose, Sucrose and Fructose) to Improve Science Process Skills.

Method

This research is a type of Research and Development (R&D) research. The product developed is in the form of excel-based practicum media to improve science process skills in level II students majoring in nutrition at the Aceh Ministry of Health Polytechnic. The sample in this study was 66 people who used a purposive sampling technique.

This study uses the Borg and Gall research and development (R&D) model. Research and Development is a process or steps to develop a new product or improve existing products, which can be accounted (Youssef & Webster, 2022). Here are the steps of Borg and Gall:

- a) Research and information collecting is a study of literature related to the problems studied, and preparation for formulating a research framework.
- b) b)Planning namely formulating problems to determine the objectives to be achieved at each stage, and if possible/necessary to carry out a limited feasibility study. At this stage the researcher begins to design components for excel-based media, create products in excel, design and duplicate spectra, determine spectrum wavelength data and make Red Green Blue (RGB) samples..
- c) Interface produk awal namely developing the initial form of the product to be produced. Included in this step is the preparation of supporting components, preparing guidelines and manuals, and evaluating the feasibility of supporting tools.
- d) Expert judgement inter-rater reliability namely at this stage the researcher will conduct an expert test on the media that was developed based on input from three media experts including the presence of interactive media and facilitation with video tutorials.
- e) Revisi setelah FGD namely making improvements to the product based on input from the previous stage. The following shows interactive practicum media and video tutorials.
- f) Main field testing merupakan stages of empirical trials involving 15 students.

- g) g)Interface final i.e. make improvements/ improvements to the wider trial results, so that the product being developed is already an operational model design that is ready to be validated.
- h) Operational field testing namely the validation test step of the operational model that has been generated. However, in this study this stage was no longer carried out because this excel-based practicum media was already feasible to use in the previous stage.
- i) Final product revision namely making final improvements to the model developed in order to produce the final product.
- j) j) Dissemination and publication namely the step of disseminating the developed product/media. The dissemination stage is the final stage of development.

Data analysis

Data collection techniques in this study were observation sheets and questionnaires. Observations were made by observing the needs of students in food chemistry courses in examination practicums. The data analysis technique used in this study was using a Liket scale consisting of 5 rating scales, namely 5 = Very Good, 4 = Good, 3 = Fair, 2 = Poor, 1 = Very Poor. The resulting data will be analyzed using the following formula (Herawati, 2016).

$$P = \frac{f}{N} \times 100 \tag{1}$$

Data analysis used the Independent t-test to see whether there were differences in Science Process Skills.

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{N_1} + \frac{s_2^2}{N_2}}} \tag{2}$$

Then the Ngain test was carried out on the student pretest and posttest answer sheets.

$$N-gain = \frac{\text{post test score} - \text{pre test score}}{\text{maximum possible score} - \text{pretest score}} \tag{3}$$

Result and Discussion

This study aims to develop excel-based practicum media with carbohydrate examination material (glucose, sucrose, and fructose) so as to improve science process skills. After an analysis test was carried out on students majoring in nutrition from the Aceh Poltekkes, it was found that practicum material was still given in the form of practicum modules, the media used was according to what had been previously determined, the material was according to the module and students followed instructions from the lecturer. Things like this are

considered to hinder student skills, especially students who are shy to ask questions. Therefore, researchers developed excel-based practicum media to support the learning process.

This media is designed using the Ms. Excel and to make it easier to use, students will be given a video guide to using the application. The initial design of this application received a lot of suggestions from supervisors.

Experts I and II assessed in terms of the feasibility aspect of presentation, namely the use of media is included in the complicated category so there is a need for guidelines for applying the media. In this case the action taken by the researcher is in the form of making a tutorial video on how to use the right media. That way students can understand the material explained effectively and efficiently. The making of this video also aims for students to be able to study independently so that it will improve students' skills and innovation in learning.

Expert III said that from the aspect of content feasibility, the compatibility between the material and the technological aspects must be clearly defined. In this case the researcher is improving the quality of the media

display so that it doesn't look like the original application.

Based on input and directions from media experts, the designs have been continuously developed so that they are suitable for use. Practicum media are developed with a more attractive appearance, easier use, and are equipped with videos that have been designed to support their use among students. In addition, when running the application, several instructions appear that must be carried out to make it easier for students to run this excel-based practicum media.

The results of the assessment of the feasibility of excel-based practicum media by the validator obtained an average of 89% or entered into the very good category. In addition, the student response test has an average value of 65.67% or is included in the good category. The results of the T Test Independent Observation Sheet and T Test SPS obtained a P value of 0.000 (P Value <0.05).

The N-gain test result of the Observation Sheet is 0.42 and the N-gain SPS test result means that it is included in the medium category because it is in the range $+0.30 \leq N\text{-gain} \leq 0.7$.

Table 1. Results of Excel-Based Practicum Media Validation by Experts

Expert	Expert Advice	Percentage (%)	Criteria	Validation Level
I	The initial appearance is made in the form of a short video such as totrial	87	very good	very valid
II	The use of media is still complicated	78	good	valid
III	The suitability between material and technology needs to be improved again to make it better	92	very good	very valid

Table 2. Results of Feasibility Validation of Excel-Based Practicum Media by Experts

No	Indicator	Total	Percentage per Number (%)
Media Feasibility Aspects			
A			
1	<i>Maintable</i> (learning media can be maintained/managed easily)	14	93
2	<i>Usable</i> (learning media is easy to use and simple to operate)	12	80
3	<i>Compatible</i> (learning multimedia can be installed or run in various existing software)	13	87
4	Effective and efficient in the use of learning media	12	80
5	<i>Reusable</i> (part or all of the learning multimedia programs can be reused to develop other learning media)	13	87
B	Aspects of Visual Communication		
1	Communicative, in accordance with the message and acceptable to the target's wishes	14	93
2	Navigation in media operations	13	87
3	Visuals (design layouts)	12	80
4	Visuals (color)	15	100
5	Animations and images in media	15	100
C	Content		
1	The suitability of the material presented in the learning media with basic competencies	14	93
2	The contents of the learning media as a whole can motivate students in learning	14	93
3	Contextuality	13	87
4	Depth and Completeness of the material	13	87

No	Indicator	Total	Percentage per Number (%)
5	Ease of material to understand	13	87
6	Systematic, coherent, logical and clear	13	87
7	Clarity of discussion descriptions, examples and exercises	14	93
8	Appropriateness of the number of exercises with the amount of material presented	14	93
9	Explanatory material can be reviewed again	14	93
10	The contents of the learning media as a whole can motivate students in learning	13	87
Overall Percentage			89
Interpretation Criteria			Very Worth it

Table 3. N Gain Observation Sheet and SPS

N GAIN	Value	Category
Observation sheet	0.42	middle
Science Process Skills	0.46	middle

Based on the figure 1, it is known that the average value of the pretest observation sheet is 31%, the average value of the SPS pre-test is 54.6%, the average posttest value of the observation sheet is 42%, the average value of the SPS is 73.5%, N gain sheet observation 0.42 while the SPS gain N value is 0.46.

Quality of Excel-Based Practicum Media

Practicum is an activity for implementing one of the four pillars of the teaching and learning process (Khairuna et al, 2021). However, since the pandemic, this activity has begun to be hampered. So that various virtual-based media developments emerged to support practicum activities (Khalidun et al, 2022). The development of virtual practicum media as a Microsoft Excel-based laboratory is one of a series of innovations so that students can still carry out practicums from home (Rokhim et al, 2020).

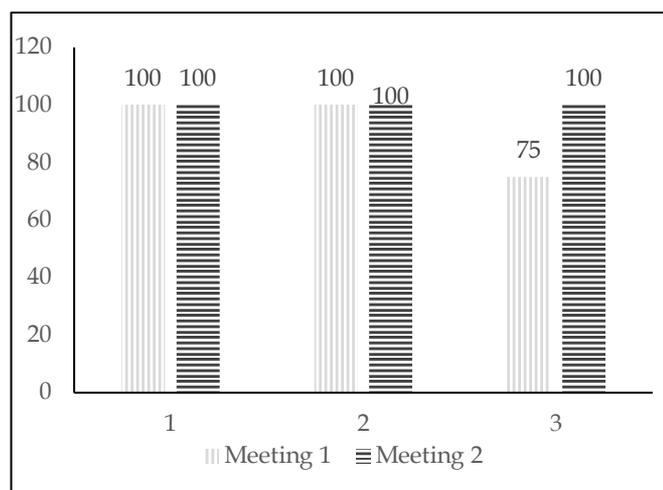


Figure 1. Graph of differences in pre-test and post-test N gain Science Process Skills and Observation Sheets

Virtual laboratories have advantages that conventional laboratories do not have, namely the ability to display visual models to reach concepts with

representation down to the sub-microscopic level so that they can attract students' interest in learning a concept that is considered boring (Rahmi et al, 2021). One software that can be applied to create interactive media such as volumetric titrations or buffer solutions (Anizar et al, 2018) is Microsoft Excel.

In this study, the media developed was the result of the design of the MS application. Excel that has been modified according to the directions and suggestions from media experts. Development is done repeatedly to get maximum results before being implemented in research. Similar research was also conducted by (Laksono et al, 2022) regarding the development of media to increase students' interest in learning. In developing a media, it is necessary to carry out various tests in order to achieve the goals of media development.

The product developed has gone through a trial phase to determine the feasibility of the product which includes the feasibility level, trials on media experts and revision activities at the stages to produce a better product (Priantini, 2020).

Media feasibility test is one of the most important tests to be carried out. The feasibility test for development media consists of three components, namely the media feasibility test, visual communication and material which obtain an average score of 89% or are included in the very feasible category. In research conducted by (Zulfadila & Arisandia, 2020) in the feasibility test the developed media obtained a result of 93.8%, meaning it was very feasible to use. Media feasibility greatly influences the level of success in conducting research in order to avoid difficulties in the field. Thus the developed media is declared feasible after several stages of revision. Good media is not only seen from its appearance, but the completeness of the material is also needed (Nurrita, 2018). According to (Muchson, 2019) in the research conducted said that the percentage of media eligibility ranged from 81-100 so that it could be said to be feasible to be implemented in teaching and learning activities. Therefore, the unity between appearance and material will support the development of this excel-based practicum media.

Apart from that, a test of students' responses to the feasibility of excel-based practicum media is also needed

to find out the percentage of students' interest in using this media in life. The benefits obtained and the desire to implement the developed media are the benchmarks for the success of a media development program. In this study, a score of 82.7% was obtained or included in the good category. This trial was also applied in research conducted by (Zulfadila & Arisandia, 2020) with a result of 84.4% or very good. This difference in value occurs because Significance shows the ability of the instrument to provide a balance of measurements based on the importance of each condition that occurs in the field (Arifin, 2019). From the results obtained from the field, this excel-based practicum media is considered feasible to be applied in carrying out student practicum.

Differences in Science Process Skills

Science Process Skills (SPS) data obtained by dividing the questions or what is known as the pretest-posttest questions. Student learning outcomes were assessed using pretest and posttest questions in the form of statement questions consisting of 8 questions regarding the material for examining carbohydrates (glucose, sucrose and fructose).

Furthermore, the pretest-posttest data obtained were then processed and analyzed with the aim of seeing student learning outcomes whether there were differences in student learning outcomes before and after the development of Excel-based practicum media was implemented. To see the results of differences in student learning outcomes researchers used the independent T test and the N-gain test.

The results of the Independent T test in this study obtained a P-Value of 0.000, meaning that there was a difference between before and after the simulation of the application of excel-based practicum media development to students' science process skills was carried out. Based on the N Gain test of the observation sheet of 0.42 or entering the medium category while the results of the N Gain SPS test carried out obtained results of 0.46 or entering the medium category. Thus based on the N Gain test it can also be seen that the application of excel-based practicum media also affects the level of students' science process skills.

From the tests conducted, it can be concluded that the use of excel-based practicum media can increase the level of students' scientific process ability. The use of excel-based practicum media is worth considering because it has the advantage of high interactivity.

Conclusion

Excel-based practicum media on carbohydrate examination material to improve science process skills are considered of high quality to use. Based on the results of the analysis, it is known that the feasibility level of excel-based practicum media is 89% or very

feasible. In addition, there is a difference between before and after the treatment with a t test result of 0.000 and there is a difference with the N gain test of 0.46 in the medium category.

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