



# Reconstruction of vitamin C test worksheet for junior high school with ANCOR stages

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Article Information	Abstract
<p><b>Keyword:</b> Vitamin C; Worksheet; ANCOR; Biology practicum; Biology laboratory</p> <p><b>Kata Kunci:</b> Vitamin C; Lembar kerja; ANCOR; Praktikum biologi; Laboratorium biologi</p> <hr/> <p><b>History:</b> Received : 13/05/2024 Revised : 15/06/2024 Accepted : 27/06/2024 Published : 29/06/2024</p>	<p>Practicum is one of the learning methods that can help students construct various psychomotor, higher-order thinking skills and characterize learning outcomes. One factor determining the practicum's success is the use of worksheets. However, currently, many worksheets do not meet the standards and do not show knowledge construction. In addition, there has been no research on the reconstruction of the vitamin C test worksheet. Therefore, it is necessary to analyze and reconstruct the vitamin C test worksheet. The method used is descriptive qualitative with three stages: analysis, trial, and reconstruction. The population in this study was represented by vitamin C test worksheets for junior high school class VIII used by teachers. The sample in this study was one of the worksheets used in learning at school, circulating on the internet, and having incomplete components. The sampling technique was purposive sampling. The analysis showed that the worksheet does not comply with the standards, so it is necessary to reconstruct the worksheet so as not to cause errors in student practicum activities. The reconstruction of this worksheet can be an alternative to overcome the current worksheet's shortcomings.</p> <p><i>Abstrak.</i> Praktikum merupakan salah satu metode pembelajaran yang dapat membantu siswa mengonstruksi berbagai keterampilan psikomotorik, berpikir tingkat tinggi, dan mengkarakterisasi hasil belajar. Salah satu faktor penentu keberhasilan praktikum adalah penggunaan lembar kerja siswa. Namun, saat ini, masih banyak lembar kerja siswa yang tidak memenuhi standar dan tidak menunjukkan konstruksi pengetahuan. Selain itu, belum ada penelitian mengenai rekonstruksi lembar kerja uji vitamin c. Oleh karena itu, perlu dilakukan analisis dan rekonstruksi lembar kerja uji vitamin c. Metode yang digunakan adalah deskriptif kualitatif dengan tiga tahapan yaitu analisis, uji coba dan rekonstruksi. Populasi dalam penelitian ini adalah lembar kerja siswa mengenai uji vitamin c di Sekolah Menengah Pertama kelas VIII yang digunakan oleh guru. Sampel dalam penelitian ini adalah salah satu lembar kerja yang digunakan dalam pembelajaran di sekolah, beredar di internet dan komponennya tidak lengkap. Teknik pengambilan sampel adalah purposive sampling. Hasil analisis diperoleh bahwa lembar kerja siswa belum memenuhi standar sehingga perlu dilakukan rekonstruksi agar tidak menimbulkan kesalahan dalam kegiatan praktikum siswa. Rekonstruksi lembar kerja ini dapat menjadi lembar kerja alternatif untuk mengatasi kekurangan lembar kerja yang ada saat ini.</p>

## A. Introduction

The independent curriculum has two main elements in science education: science understanding and process skills to apply science in everyday life. These process skills include observing, questioning, predicting, planning, investigating, processing, analyzing data and information, evaluating, reflecting, and communicating results. These skills can be trained through practical activities.

Practicum is learning that involves students interacting with the learning environment (Bond et al., 2020). According to Hamidah et al. (2014), practicum is one of the strategies in learning that covers the affective, cognitive, and psychomotor domains. Meanwhile, according to Millar (2004), the practicum is an activity that connects "two domains," namely the domain of objects or phenomena that can be observed in the real world (hands-on) with the domain of ideas or thoughts (minds-on). Rustaman (2005a) stated that practicum is an effective method to achieve learning objectives. Practicum activities aim to improve students' understanding and support science process skills (Harlis & Budiarti, 2017). Practicum can help students understand the concepts learned in class (Ulfa et al., 2022) and provide new learning methods for students (Setiawati & Handayani, 2018). Practical activities can also construct various psychomotor skills higher-order thinking, and characterize learning outcomes (Supriatno, 2018). Practicum can be used to assess the development of students' scientific knowledge, which should be assessed from the process rather than the result of the investigation (Abrahams & Millar, 2008). The importance of practicum, according to Rustaman (2005b), is because practicum can foster motivation to learn science in students, can be the basis for developing competence in carrying out experiments, as a means to learn the scientific approach, and a means of supporting the lesson. Science education experts also state the same thing regarding the importance of practicum activities, namely generating motivation to learn science, developing basic skills in carrying out experiments, being a vehicle for learning a scientific approach and supporting understanding of subject matter (Bybee & Powell, 2014; Woolnough & Allsop, 1985).

One of the factors determining the success of practicum activities is student worksheets, commonly abbreviated as student worksheets. A student worksheet is a guide for practicum activities that can help students to construct their knowledge. Student worksheets contain instructions for carrying out practical activities, which, according to Rustaman & Wulan (2007), consist of several aspects, namely: (1) activity objectives, (2) introduction (in the form of theoretical basis), (3) tools and materials, (4) work procedures, (5) how to assemble tools, (6) interpretation of observation data, (7) data analysis and (8) conclusions. Meanwhile, according to Trianto

(2007), the worksheet aspects include the title of the experiment, a brief theory of the material, tools, and materials, experimental procedures, observation data, and questions and conclusions for discussion. There are many benefits obtained through the use of worksheets, such as facilitating educators in managing the learning process, helping educators direct their students to be able to find concepts through their activities or in work groups, can be used to develop process skills and develop scientific attitudes and help educators monitor the success of students to achieve learning goals (Salirawati, 2004). A good worksheet will provide a conducive practicum atmosphere, the achievement of learning objectives, and the growth of student independence in constructing their knowledge. A well-structured worksheet will support implementing a practicum activity (Zahra et al., 2021).

Based on the results of Supriatno's research (2013), it was found that only 24% of all worksheets analyzed could be used with results according to the procedure and complete in terms of data analysis and conclusion drawing, so there are still many worksheets that do not show knowledge construction, while Millar (2004) states that the effectiveness of a practicum can be achieved if there is a match between objectives, work tasks, classroom activities, and student learning processes. According to Supriatno (2018), several problems often arise in writing worksheets, namely: (1) practicum objectives that are more inclined to cognitive aspects than psychomotor aspects, (2) discrepancies between practicum objectives and data obtained and difficulties in identifying observed objects, (3) practicum procedures are sometimes unstructured and confusing instructions and have the opportunity to cause different interpretations, and (4) selection of material without considering its substance, suitability, depth, and complexity. To overcome these problems, analysis, trials, and reconstruction were carried out on a worksheet on the "Vitamin C Test" circulating on the internet and used by teachers and students. Currently, there is no research related to the reconstruction of the worksheet on the "Vitamin C Test" using the ANCOR stages. The stages of analysis, trial, and reconstruction, abbreviated as ANCOR, were developed by Supriatno (2013), with the initial stage in the form of analysis of a worksheet using five indicators, then worksheet trials were carried out in the laboratory. Finally, reconstruction was carried out on the parts that needed improvement.

## B. Material and method

This research used a qualitative descriptive method. The research was conducted at the Biology Laboratory of FPMIPA Universitas Pendidikan Indonesia from February to May 2024. The population

in this study was the worksheet of junior high school class VIII on vitamin C tests used by teachers in carrying out laboratory activities. The sample in this study was one of the worksheets of vitamin C tests used in learning at school, circulating on the internet, and having incomplete worksheet components. The sampling technique used was purposive sampling. This research uses the ANCOR (Analyze, Trial, and Reconstruct) stages developed by Supriatno (2013), as shown in Figure 1. In the first stage, the worksheet was analyzed using an instrument containing five indicators based on the vee diagram developed by Novak & Gowin (2006). The five indicators are focus questions, objects/events, theories, principles and concepts, recording/transformation, and knowledge claims. After the analysis process is complete, testing activities are carried out on the worksheet to find out whether this worksheet can bring up objects or phenomena that can help students construct their knowledge. The last step is to reconstruct the parts that need improvement.

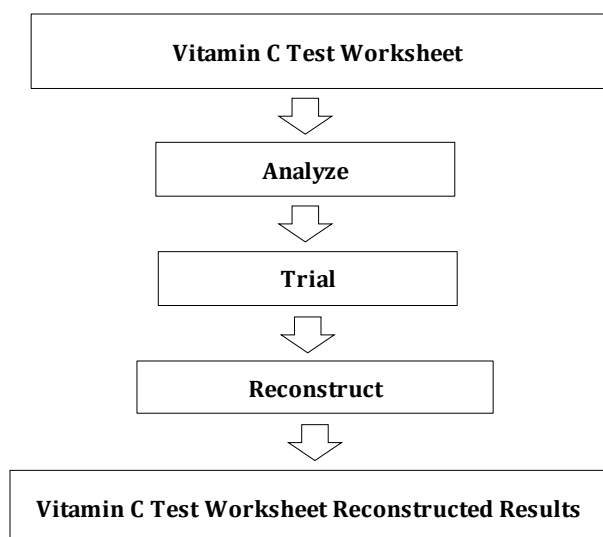


Figure 1 ANCOR stages (Source: Supriatno, 2013)

### C. Results and discussion

In the first stage of ANCOR, the worksheet on the vitamin C test was analyzed using five indicators, as shown in Table 1. The lowest total score on each indicator is 0, and the highest is 4.

**Table 1 Indicators of worksheet analysis**

Indicators	Score range	Score obtained
Focus question	0 - 3	3
Object/events	0 - 3	0
Recording/transformation	0 - 4	2
Theories, principles, and concepts	0 - 4	2
Knowledge claims	0 - 4	3
<b>Total</b>		<b>10</b>

Based on the analysis results, the score obtained by this worksheet is 10 out of the total highest score of 18. This worksheet has a clear and identifiable focus question, covering the concept to be used and suggesting the main event and its accompanying objects. However, no objects or events are identified due to the inappropriate use of tools, materials, and procedures. Data recording or transformation can be identified, although the table on the worksheet is imperfect. The worksheet also identifies concepts and at least one type of relevant principle. Finally, the knowledge claim includes the concept from the focus question and is derived from the recordings and transformations.

Previous research proves that ANCOR stages can be used to analyze and construct worksheets. The research results by Frima et al. (2021) stated that the food ingredient test worksheets analyzed still have many deficiencies and must be reconstructed. The same thing was also conveyed by Putri et al. (2020), who stated that the food test worksheets analyzed did not show knowledge construction. Several other studies regarding the analysis and reconstruction of food substance test worksheets, such as those conducted by Andriyatno & Supriatno (2023); Zahra et al. (2021), only centered on carbohydrate, protein, and glucose tests. However, none of these worksheets analyze the vitamin C test worksheet. Therefore, further analysis of the vitamin C test worksheet is needed because the vitamin C test is one part of the food substance test, which is as important as other food substance tests. With the analysis of the vitamin C test worksheet that has never been done before, a worksheet will be produced that can help students form their knowledge independently so that previous research on the analysis of carbohydrate test worksheets, protein tests, and glucose tests will be complete with the results of the analysis of the vitamin C test worksheet.

#### Analysis Stage

In this worksheet, focus questions can direct students to focus on various aspects of the event or object to be observed. However, there are no practical objectives in this worksheet, which are an essential part of a worksheet and will later become a guide in determining the steps to be taken during the practicum. They are closely related to the focus question. The absence of practicum objectives causes unclear objectives to be achieved in practicum activities. It has the potential to widen the boundaries of the material so that the material becomes too complex. According to Novak & Gowin (2006), material that is too complex can create noise in students, making them unfocused. Good practicum objectives will be relevant to the curriculum (essential) and focus on activities that construct factual, conceptual, and procedural knowledge.

The second indicator is objects/events strongly influenced by the use of tools, materials, and work procedures. In this worksheet, there is a mismatch between tools, materials, and procedures, where there is no explanation regarding the size and units of the tools and materials used. There are differences in tools and materials in the list of tools and materials with those found in the work procedures. Then, many tools and materials are mentioned, but their uses are not explained. There are even tools that are not used during practicum but are written in worksheets. This will confuse students, so they cannot do the practicum independently, which will make practicum activities ineffective. In the work procedure, it can be seen that the steps written on the worksheet are not systematic and not detailed, so they can trigger the emergence of phenomena that can be observed. According to Saputri et al. (2022), detailed unstructured lab procedures and poorly understood instructions can lead to different understandings. Not observing objects or phenomena during practicum will cause failure in students when forming new knowledge. In addition, in this worksheet, there is no safety procedure, as the tools used are made of glass, and the material can cause irritation if not used carefully. This is dangerous, considering that students are still in junior high school and do not have a high level of caution.

The next indicator is data recording. Data recording will be based on observation results. According to Supriatno (2018), observation is an integrated activity between psychomotor skills and cognitive processes to find the character of an object/event with or without using tools. After making observations, data will then be recorded by recording. In this worksheet, there is a command to record data in tabular form. The table provided in this worksheet is quite representative and can help students organize quantitative and qualitative data to facilitate data interpretation. The data that will be obtained from observation can be qualitative or quantitative. A well-designed observation table will help students to see the relationship between facts. Recording data will be related to data transformation, where in this process, students convert the factual knowledge they get based on observations into conceptual knowledge. The worksheet's observation table can help students see the facts observed and build concepts based on these facts. In addition, the worksheet's questions help students interpret data that will lead students to concept formation. The questions asked in this worksheet can only be answered if students do practical activities so that students are motivated to investigate. According to Carin (1996), science means scientific methods or activities to describe natural phenomena to obtain scientific products in the form of facts, principles, laws, or theories. According to Supriatno (2013), if the components of notes and transformation are not

owned, it is less able to increase students' self-awareness so that the metacognitive process to understand and interpret the results of observations is not facilitated. Based on the various explanations above, it can be said that there are still various deficiencies in the worksheet, so it is necessary to reconstruct the worksheet, especially the absence of practicum objectives, as the most important part of a worksheet that will determine the expected achievements of students. An important principle that should be present in the worksheet is the objective.

### Trial Stage



Figure 2 Trial stage process

The trial was conducted by experimentation, as shown in Figure 2 on the worksheet. The purpose of this trial is to determine whether the worksheet can bring students to the stage of constructing their knowledge through practical activities. Overall, the activities in the worksheet have not been able to bring up the expected phenomena to construct knowledge in students.

Based on the trial results, several discrepancies were found in the tools and materials used in the work procedures. In the worksheet, many tools cannot be used for certain functions and should be replaced with other tools. For example, the use of a drip plate as a container while when the drip plate is dripped with twenty drops of betadine as an indicator, the drip plate is almost full, so it is feared that when dripping the ingredients to be tested, the drip plate cannot accommodate the solution and spills. This will certainly interfere with implementing practical activities and affect the phenomena that should be observed. Then, the worksheet does not write instructions and tools that can be used to smooth vitacimin in tablet form, while the vitacimin that is dripped on the indicator must be a solution. Likewise, with cornstarch in powder form, it is necessary to write the amount of water needed to dissolve it. In addition, cayenne pepper extract is needed in practical activities, but the amount of cayenne pepper used and the steps for making the extract are not written. Inappropriate steps in the preparation of cayenne pepper extract will cause the phenomenon not to appear. Errors in using tools, materials, and practical procedures can cause students to make mistakes when answering questions that help build their knowledge.

### Reconstruction Stage

In the reconstruction stage, the worksheets were rearranged, and improvements were made to some parts based on the results of the analysis of each worksheet component in the first stage. It is hoped that with this reconstruction, the practicum activities carried out by students can be more meaningful because, according to Nadia et al. (2020), worksheets in schools have not been able to facilitate students' carrying out meaningful practicums. The reconstructed worksheets also focus on process skills to support the successful implementation of the independent curriculum. Previous research conducted by Faidah et al. (2022) stated that reconstruction can realize the laboratory skills competencies students need. This is in line with what Darmawati et al. (2021) said: redesigning this worksheet is to develop 21st-century skills. This reconstruction is expected to be a reference for student teaching materials, so reconstruction on worksheets is very important.

Based on Table 2, we can see the problem points found in the vitamin C test worksheet. These problems include the absence of practicum objectives,

the use of tools and materials that are not appropriate, not specific and not explained in the procedure, inconsistencies in the tools and materials used both in the list of tools and materials and in the procedures and observation tables, procedures that are not systematic and detailed, no safety instructions, and recording and interpreting data that are not following the objectives of the practicum. Therefore, various improvements are needed in terms of conceptual, procedural, and knowledge construction. According to Ramadhayanti et al. (2020), these improvements are important so that the worksheets meet the needs of students and can be used in the learning process at school. Siregar et al. (2022) stated that this reconstruction will optimize practical activities that empower students' skills. According to Gusti & Supriatno (2023), the reconstruction carried out on the worksheet is expected to complement the shortcomings of the current worksheet.

Figures 3 and 4 are the reconstructed worksheet that has carried out and is expected to be used by teachers to help form student knowledge on vitamin C test material.

**Table 2 Results of the worksheet reconstruction trial**

<b>Problems on the worksheet</b>	<b>Solutions</b>
There is no practicum objective.	Make clear practicum objectives that align with the title and curriculum outcomes. According to Millar (2004), the first characteristic of an effective practicum is that the objectives of the practicum are clear because these objectives will determine how the practicum will be conducted.
The tools and materials used are inappropriate, such as using a drip plate as a container for dripping fruit juice.	The drip plate was replaced with a test tube so that the color change and amount of solution could be more easily observed.
Tools and materials are not specified.	Added specifications on tools and materials. Sumarmin & Roza (2019) explained that presenting information about tools and materials is important before practicum activities are carried out so that the implementation is not interrupted.
The use of tools is not explained in the procedure.	The use of tools is explained in the procedure so that students can carry out practical activities independently.
There is a discrepancy between the tools and materials in the list of tools and materials and those in the procedure.	Consistent writing tools and materials so as not to confuse students.
Work procedures are not detailed and systematic.	Make detailed and systematic procedures to bring out the expected phenomena. Laelasari & Supriatno (2018) stated that the presence of improper work steps in a worksheet can reduce the level of work effectiveness.
There are no safety procedures.	Make safety procedures so that students are careful when doing lab work. Indarwati (2020) states that work safety procedures in the laboratory are important to avoid or minimize work accidents.
Data recording and interpretation were not based on the purpose of the practicum.	Set up a data recording table that suits the purpose of the practicum. According to Novak & Gowin (2006), incorrect records and forms of transformation will result in the absence of valid knowledge claims.

In Figure 3, we can see the first page of the reconstructed worksheet. In the beginning, the purpose of the practicum has been seen, which refers to the success or failure of practicum activities carried out by students. This practicum aims to test the vitamin C content of various types of fruits. Separating the points of tools and materials and their clear

specifications will make it easier for students to do the practicum. The procedures presented are also systematic and detailed to minimize errors when students do the practicum. Then the worksheet was also equipped with safety procedures to avoid accidents when students do the practicum, especially if the tools and materials used can endanger them.



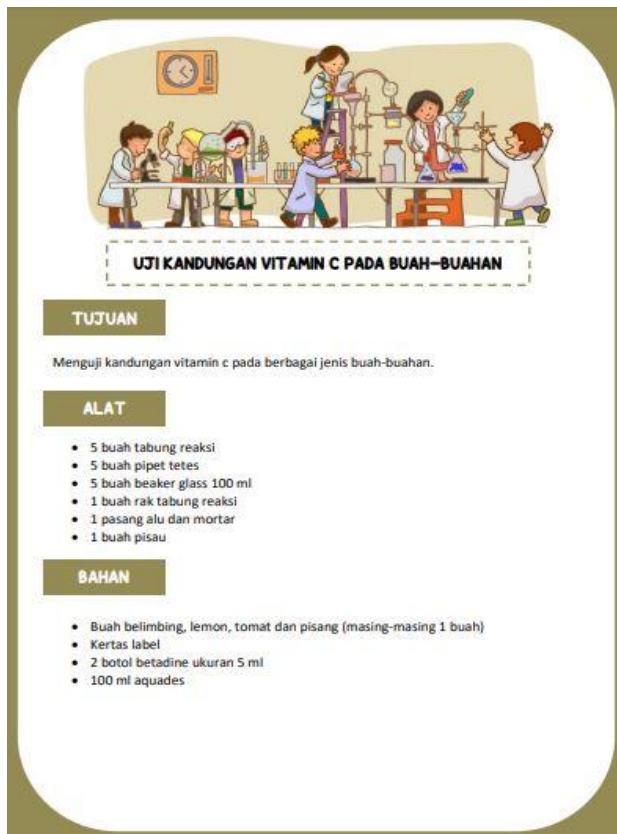


Figure 3  
 First page of reconstruction result worksheet (in Indonesian)

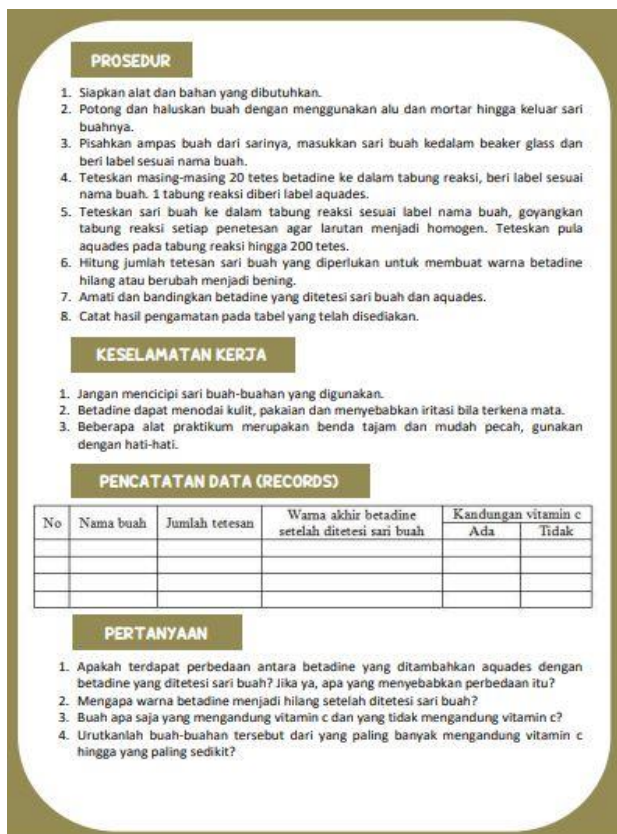


Figure 4  
 The second page of worksheet reconstruction result (in Indonesian)

The second page of the reconstructed worksheet is shown in Figure 4. The table on the worksheet will make it easier for students to organize the data so that it will be easier to interpret. According to Supriatno (2013), if the notes and transformation component is not owned, it is less able to increase students' self-awareness, so their metacognitive process to understand and interpret the results of observations is not facilitated. The same thing was also conveyed by Gusti & Supriatno (2023), that improper recording will make it difficult for students in the knowledge claim process. Then, the four questions on the worksheet are related to the practicum activities carried out and can help students construct their knowledge. According to Lathifah et al. (2022), the questions posed on the worksheet should only be answered based on the experiment's results, not obtained from the book, so that knowledge acquisition is consistent with the data obtained.

## D. Conclusion

Based on the results of the analysis and testing of the worksheets used by teachers and students, it was found that there were discrepancies between the worksheets and several aspects that should be included in the worksheets. The analysis results found that the score for the worksheet was in the poor category, so it needed to be revised. Then, at the trial stage, there were many errors in both tools, materials, and procedures, so the phenomena expected in the practicum did not appear, making students mistaken in concluding the concepts that students should get. Therefore, the reconstruction carried out on the "Vitamin C Test" worksheet can be an alternative worksheet to complement the various shortcomings in the current worksheet. Furthermore, these reconstructed worksheets can be tested again to determine their effectiveness.

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