Optimize use of icare based student worksheet (ICARE-BSW) in physics learning at the introduction level

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Abstract. ICARE-Based Student Worksheet (ICARE-BSW) was a learning tool equipped with the ICARE (Introduction, Connecting, Apply, Reflecting, and Extend) steps used in the learning process and its achievement activities. Researchers have conducted a limited test of the use of ICARE Based Student Worksheet (ICARE-BSW) with 6 groups of Students on 5 ICARE Based Student Worksheets (ICARE-BSW) with different tools. Learners have been done on the Student worksheet by following the steps of ICARE. In addition, at the end of the meeting also carried out the responses to the use of the Student Worksheet, appearance, and understanding of the tools. This response was a major source of development and change that will be applied to the improvement and progress of the ICARE Based Student Worksheet (ICARE-BSW). The results of the responses show that the ICARE Based Student Worksheet view is interesting, the learning tools are lacks, and it needs to be developed again work instructions on the use of ICARE Based Student Worksheet (ICARE-BSW) in learning. Further development is directed towards improving the tools, quality, and quantity of ICARE-Based Student Worksheet (ICARE-BSW) use in the application of large group trials at different grade levels. The researcher provided a response questionnaire to see the Student's responses about the ease of access, adequacy of content, and appeal of the use of ICARE-Based Student Worksheets (ICARE-BSW) involving Educative Participants in interacting and improving productive skills and knowledge in learning. The results of a questionnaire of responses illustrate that the use of ICARE Based Student Worksheet (ICARE-BSW) is good enough in improving student's skills on physics introduction level.

1. Introduction
Science process skills are very important to be trained and developed this is because as a scientific skill that is owned and used by students to perform various scientific activities so as to produce new knowledge and understanding for students of a concept or theory. Science as a practical subject gives students the opportunity to interact with science process skills that can be used to solve problems in everyday life and contribute to national development. Science process skills are activities, which principals do in scientific inquiry to enable the acquisition of knowledge and scientific skills (Abungu, 2014). The importance of teaching science process skills is to enable students to describe objects and events, ask questions, construct explanations, test those explanations for existing scientific knowledge and communicate their ideas to others (Opara, 2011).
Science process skills themselves consist of basic skills and integrated skills (Dimiyati & Mudjiono, 2013: 140). To develop these skills, a learning approach is needed which makes learning leads to scientific nature, one of which is to use a scientific approach (Jaya, 2014). Process skills have a role in the process of forming scientific knowledge. Process capability can affect student development, as shown by several studies that have been conducted. Process skills development can support students' thinking and function as support for other cognitive skills such as logical thinking skills, reasoning, investigating, and evaluating support for problem-solving abilities, and support for creativity (Özgelen, 2012). Process skills are also important for meaningful learning (Karamustafaoğlu, 2011) With process skills, participants can experience firsthand the objects and events around them (Osman, 2012).

One type of learning that is leaning towards direct experience is inquiry learning. Inquiry learning can provide an instructional framework that helps to ensure that students develop a broader intellectual scope and scientific process skills (Wenning & Mansoor, 2011). In inquiry learning the process skills observed are observation, hypothesis construction, data interpretation, drawing conclusions, and the results of research on communication or dissemination skills (Hardianti & Kuswanto, 2017). Inquiry learning using experimental methods is recommended to be applied. Teaching physics by applying experimental methods can make students more active in the implementation of learning. The experimental method itself has the aim that students gain experience and skills in conducting experimental activities, and can use and carry out scientific method and scientific thinking procedures (Putra, 2013: 138).

Feyzioglu (2009) conducted research at the university level and the results showed a positive relationship between science process skills and university student achievement. Research conducted by Yurumezoglu (2013), shows that the experimental and demonstration methods have a positive influence on student learning achievement. So that the form of development of this research is the use of Teaching Tools oriented ICARE Based Student Worksheet is expected to build Science Process Ability of students and make learning more directed and systematic. Student Worksheet is one of the Teaching Tools used to achieve success in physics learning. Student Worksheet is a learning tool that has been packaged so students are expected to be able to learn certain learning tools independently. Teaching Tools in the form of worksheets used are ICARE-oriented Worksheets. ICARE-oriented Teaching Tools are printed learning tools that are packaged in book form where each subject matter is arranged sequentially: discussion of essential concepts, examples of questions, practice questions, and Student Worksheet which are arranged systematically in an introduction, connect, apply, reflect, extend (ICARE) in order to train students' science process skills. As advances in education and technology make a lot of research that produces the latest breakthroughs in the world of education, and ICARE is one of the effective learning strategies in the e-learning environment that is produced through continuing research. The ICARE learning strategy emphasizes active, creative, and joyful learning (Wahyudin, 2010).

The extension phase is an activity where the teacher presents activities that can do the following lessons to strengthen and expand learning (Carni, 2017). Strengthening activities carried out can be in the form of a teacher directing students to access several internet sites to be able to resolve the problems discussed in learning. In accessing these sites can be done outside of classroom activities, so as to provide reinforcement of the knowledge possessed by students. The ICARE strategy is designed for online learning. But there are many obstacles when ICARE learning that is designed for online learning is not supported by the existence of adequate tools and systems to access the internet so that learning using this strategy is very difficult to implement. Usually, in learning using ICARE strategy Online learning is done at the connect stage, meaning students are given instructions to connect the subject matter to the problems discussed in the lesson with the help of accessing the internet. As previously explained that it is very difficult to do when in school or on a campus it does not have an adequate support system such as in rural areas that are very difficult to access the internet, do not have the tools or devices that will be used to access the internet and school culture that severely limits the use of gags in learning.
Based on the constraints that occur, ICARE learning referred to in this study is the provision of Teaching Tools accompanied by ICARE Based Student Worksheet. ICARE learning provides opportunities for teachers to make special modules (Teaching Tools) depending on the consideration of students’ abilities. Teaching Tools that have been developed are arranged according to the characteristics and needs of students. The instructional tools that have been prepared are intended to overcome the connect stages so that with the Teaching Tools students no longer have difficulties in learning. The Teaching Tools students no longer need to access the internet because when learning using ICARE Based Student Worksheet is carried out especially at the connect stage, students are directed to be able to connect their knowledge using Teaching Tools that have been prepared by educators. ICARE Based Student Worksheet which is arranged systematically so that student learning is more structured. At each stage of learning using ICARE Based Student Worksheet will provide learning experiences for students to understand essential concepts and train students' science process skills. So that learning is carried out in accordance with ICARE principles, namely presenting essential tools for each topic. Optimizing the use of Teaching Tools equipped with ICARE Based Student Worksheet, it is expected to improve the learning achievement of Physics Introduction Level.

2. Methods
Researchers have tested the limited use of ICARE-BSW with 6 student groups on 5 ICARE-BSW with different tools. Students work on the Student Worksheet by taking part in the ICARE phase. Each student is given five ICARE oriented worksheets. Before working on the worksheet, the researcher provides information about how to use worksheets and competencies that students must do. Competencies that must be mastered by students are published in the ICARE phase. In addition to the ICARE-BSW, students are given teaching books to help students analyze and report on their activities. Students work based on worksheet instructions. Each group is required to analyze and report on each worksheet to be assessed by the researcher. The instruments used to measure the understanding of physics concepts and students' problem-solving abilities are fields that have been loaded in accordance with the stages of ICARE-BSW. In assessing work results, students are assessed based on the rubric in depth of the concepts used and their suitability in answering the questions asked. In addition, the assessment is also aimed at making a decision on the solution to the problem raised. The weaknesses obtained in the first worksheet activity report are used as a reflection of the increase in the use of the next worksheet. These results are the main sources of development and changes that will be applied to the improvement and progress of the ICARE-BSW. The results will be analyzed in terms of understanding and solving the problems proposed in the concept of physics submitted through the given worksheet. The results of the analysis will be used as a reflection of learning in improving the concept and understanding of learners to be developed as a learning plan in perfecting the application of ICARE-BSW.

3. Results & Discussion
The stages of ICARE-BSW teaching tools contain titles, goals, problems, formulation of hypotheses, data collection and discussion, and conclusions. The results of the review in the assessment of the performance of the instrument use show that some parts of the stage experience misconceptions as shown in Figures 1.a and 1.b.

Figure 1.a which shows suitability and is more systematic in describing the procedure of data collection both in terms of illustration and procedure planning offered by students in providing solutions to the problems raised. Different in the data collection section in Figure 1.b experiencing misconceptions about the relationship of the magnitude of the slope angle with the length of the side that forms the slope angle; The data written by students shows that there is no effect of changes in slope angle with changes inside length that flank the slope angle, in this experiment the side length is called distance (s) and height (h). The occurrence of misconceptions in writing experimental data for writing distance (s) and height (h) due to "weak" student's ability to the concept of trigonometry, they believe that their measurement results are correct without considering the principles of trigonometry.
Another concept that occurs in Figure 1.b is that students have not used trigonometric concepts in describing the components of force in vertical and horizontal directions, but writing the style components is based on their experience in working on physics test questions. The solution made by students prioritizes the final answer to the test problem rather than the process. The weak ability of students in analyzing the components of the style as a whole that works on objects that are on a flat plane or an inclined plane has the effect of solving the test problem. This research is supported by research conducted by Azman, Ali & Mohtar (2013) explaining that students find it difficult to understand the vector directions of the force component acting on an object, which has an impact on student confusion in analyzing the pair of action and reaction forces for the overall components of the force an object. Another misconception about Newton's laws of style. Resbiantoro & Aldila (2017) explains that it is impossible for an object to move if there is a force opposite the direction of its movement. Kurniawan (2018) added that the range of students' misconceptions related to Newton's second law is in the high and medium categories. The explanation states that for efforts to increase mastery of the concept of physics is needed.

The results of the review on the assessment of the work of the discussion section shown in Figure 2.a shows the misconception in analyzing the results of the business obtained in the experiment. Statements and explanations about the business given are not proven mathematically only from the students' arguments. In the picture, there is no mathematical elaboration and calculation to look for the relative errors that exist. Different in Figure 2.b which shows evidence in the form of a calculation that shows the difference from the calculation results as part of the statement and explanation of business and energy tools with relative errors obtained through comparison of results in theory and practice. Student work related to the discussion shows that the application of ICARE-BSW can find significant information in the analysis process of students' thinking in presenting a very significant solution that has differences based on the ability of students as nurturance in learning and as students' basic knowledge of the topics. The results of a review of the analysis of student activities to practice observations indicate that there is a match if the test application is accompanied by a picture that can be observed as an object (Figure 3). It can also train students to be careful and focus on the object being observed. Student observation ability is also considered as one of the expected capability indicators in the application of ICARE-BSW. The observation exercise in Figure 3 shows that the observation ability is good; what needs to be improved is the accuracy of unit writing. The writing of a unit of magnitude is very important to be carefully examined by students before the activity report is submitted to the lecturer giving the lecture.

The results of the review of the analysis in Figure 4 show the description of the conclusions written by students different from the objectives of the experiments conducted by students. In this case, students often experience lost focus on what is the true goal of the experiment. This can happen if in the application of ICARE-BSW students do not really follow the instructions according to the instrument. Evidence of students' lack of focus on writing conclusions in Figure 4 illustrates number 1 conclusions related to Newton's third law which are not related to Newton's first law experiment. Some examples of concept errors presented in this paper illustrate the need for continuous improvement in physics learning.
E. PENGUMPULAN DATA

Pelajari konsep usaha, energy dan hukum kekekalan energi dari beberapa buku atau internet yang relevan dan lakukan kegiatan penyelidikan untuk membuktikan hipotesis yang Saudara telah rumuskan. Tuliskan data pengamatan yang Saudara dapatkan dari percobaan.

Gambarah alat seperti terlihat pada gambar berikut!

- Letakkan:
  1. Hubungkan dinding dengan meja (gunakan kuing karen gantung)
  2. Tunng hilo di dinding
  3. Tunng hilo di bawah pengorak

Prosedur Percobaan:

1. Menyiapkan alat dan bahan.
2. Menyulur, sedikit tinggi, meningit, 30°.
3. Mendorong bola sampai ke titik puncak.
4. Menukar angka yang tertera pada dinamometer yang menunjukkan berat gars yang telah dialami.
5. Mengukur jarak yang ditempuh bola.
6. Memperbarui sudut bidang, mengejut 60°, 90°, 45°
7. Mengulangi langkah 3-5.

Figure 1.a. Correct data collection
E. PENGUMPULAN DATA

Pelajari konsep usaha, energi dan hukum kekekalan energi dari beberapa buku atau internet yang relevan dan lakukan kegiatan penyelidikan untuk membuktikan hipotesis yang Saudara telah rumuskan. Tuliskan data pengamatan yang Saudara dapatkan dari percobaan.

*Data Misconcepton Collection*

| No | Besar Sudut | Jarak (cm) | Rata-rata (kg) | Kekakalan (cm) |
|----|-------------|------------|----------------|----------------|
| 1  | 30°         | 0.4 cm     | 0.8            | 0.4 m          |
| 2  | 45°         | 0.5 cm     | 0.6            | 0.4 m          |
| 3  | 60°         | 0.6 cm     | 0.4            | 0.4 m          |

**Pernyataan**

\[ F \cdot \cos \theta = 0 \]

\[ \tan \theta = \frac{F}{T} \]

\[ T = \frac{F}{\sin \theta} \]

**Pemecahan**

\[ T = \frac{F}{\sin \theta} \]

\[ T = \frac{F}{\sin \theta} \]

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**Figure 1.b. Data misconception collection**
F. PEMBAHASAN

Lakukan pembahasan secara mendalam hasil penyelidikan yang Saudara peroleh. Dalam pembahasan kaitkan dengan teori yang relevan.

1) kondisi kejadian benda berada di bangunan datar (tidak ada perubahan sudut)

- Sesuai dengan konsep usaha dan energi hasil usaha akan sesuai yang memudahkan benda bergerak dan secara matematis usaha (W) = F\cdot s \cdot \sin \theta \quad \text{adalah sudut } \theta \quad \text{maka}

W = F\cdot s \cdot \sin \theta \quad \text{artinya karena } \theta = 0^\circ \quad \text{adalah } W \quad \text{usaha yang harus dilakukan secara langsung untuk mendorong benda tersebut agar bergerak)

2) kondisi kejadian benda di belok mengalami sudut

kejadian mendorong benda di belok menunjukkan gaya dorong yang dikeluarkan sistem dikurangi dengan profero gaya berat terhadap sudut \( \sin \theta \) mula usahaanya telah

besar (secara dengan data)

Figure 2.a. Less discussion is suitable for learning objectives;
F. PEMBAHASAN

Lakukan pembahasan secara mendalam hasil penyelidikan yang Saudara peroleh. Dalam pembahasan kaitkan dengan teori yang relevan.

\[
\begin{align*}
W_\alpha^0 &= F_s \times 4.00 \times 10^{-2} \\
&= 92 \times 10^{-2} J \\
&= 0.92 J \\
&= 0.91 J \\
W_\beta^0 &= 2.60 \times 10^{-2} \\
&= 1.2 \times 10^{-2} J \\
&= 1.2 J \\
W_\gamma^0 &= 1.69 \times 10^{-2} \\
&= 1.7 J \\
W_\delta^0 &= 3.0 \times 10^{-2} \\
&= 3 \times 10^{-2} J \\
&= 3 J \\
W_\varepsilon^0 &= 0.5 \times 10^{-2} \\
&= 0.5 J \\
&= 0.5 J \\
W_\zeta^0 &= 0.2 \times 10^{-2} \\
&= 0.2 J \\
&= 0.2 J \\
\end{align*}
\]

Good

PERMUTASI KESALAHAN RELATIF DENGAN MEMBANDINGKAN HARA DENGAN PERHITUNGAN TEORI

Figure 2.b. Discussion according to learning objectives
1. Ketelitian jangka sorong adalah \( \frac{3}{4} \) mm

2. Skala utama (SU) = \( \frac{3}{4} \) cm = \( \frac{3}{4} \) mm
   Skala Nonius (SN) = \( \frac{3}{4} \) mm
   Ukuran benda = SU + SN = \( \frac{3}{4} \) mm + \( \frac{3}{4} \) mm = \( \frac{3}{4} \) mm

3. Skala utama (SU) = \( \frac{3}{4} \) cm = \( \frac{3}{4} \) mm
   Skala Nonius (SN) = \( \frac{3}{4} \) mm = \( \frac{3}{4} \) cm

**Figure 3.** Observations through Images
Figure 4. The Student conclusion of the experimental results from Newton's first law

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