# LEMBAR
## HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
## KARYA ILMIAH : JURNAL ILMIAH

Judul Artikel Ilmiah      : The Development of Students' Worksheets Face to Face Online Based on Hypercontent on Temperature and Heat Topic

Penulis Artikel Ilmiah      : Kheruddin, Rahmawati, Nurfazlina, Salwa Rufaida, Nurhayati

Identitas Jurnal Ilmiah      : a. Nama Jurnal      : Jurnal Penelitian Pendidikan IPA

         b. Nomor/Volume/Hal    : Volume 8, Issue 6,3011-3019
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Bidang Ilmu    : Pendidikan Fisika
Jabatan/Pangl : Lektor Kepala/Pembina Tk I

# The Development of Students' Worksheets Face to Face Online Based on Hypercontent on Temperature and Heat Topic

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**Abstract:** The 21st century is a century that encourages humans to integrate life with ICT and education is no exception. However, in reality, in SMA Muhammadiyah 1 Unismuh Makassar, the use of technology such as mobile phones and the use of teaching materials is still lacking. Therefore, one of the efforts made is to produce hyper-content-based student worksheet so that students are more interested in learning physics. This study aims to describe the content validity of hyper-content student worksheet on temperature and heat topic. Furthermore, the goals of this research was to describe the practicality of the response of teachers and students to hyper-content based student worksheet on the temperature and heat topic, and describe the effectiveness of student worksheet for the given questions. This research is a type of development research (R&D) using the ADDIE model design (analysis, design, development, implementation, and evaluation). The results showed that the feasibility of hyper-content-based student worksheet based on the assessment of valuators 1 and 2 was categorized as very feasible, with the percentage of student worksheet validation 96.0%. Teachers and students gave a very positive response to the practicality of the student worksheet based on hyper-content- as a learning medium with a teacher response percentage of 100.0% with very practical criteria and student responses 84.37% very practical criteria. The effectiveness obtained from the students' test results of 0.59 criteria is quite effective.

**Keywords:** Face to face content; Hyper-content, Learning physics, Temperature and heat topics

## Introduction

The digital era as a result of technological advances has had a tremendous impact on the entire fabric of human life. The changes in people's lives are increasingly advanced and rapidly marked by the entry of the industrial revolution 4.0 (Xu et al., 2018). According to (Lase, 2019), with the increasingly convergent boundaries between humans, machines and other resources, information and communication technology certainly has an impact on various sectors of life. One of them is the impact on the education system in Indonesia. Because facing the passage of RI 4.0, the world of education must also anticipate starting earlier

with Education 4.0 as a small step to deal with this phenomenon (Kelchen, 2018; Schneider, 2018).

Education 4.0 is a term used by education experts to integrate cyber technology in learning (Grodotzki et al., 2018; Hariharasudan et al., 2018; Prieto et al., 2019; Mar'atus et al., 2018; Prieto et al., 2019). Education 4.0 is a response to the needs of the industrial revolution 4.0 where machines and humans are aligned to find solutions, solve problems and find new innovation possibilities (Fuadi, 2019). Early 2020 which required the implementation of online learning (Distance Learning) based on the Circular Letter of the Minister of Education and Culture of the Republic of Indonesia No. 3 of 2020 concerning Prevention of Covid-19 in Education units, all higher education in Indonesia, required students

. home to support the government's call for physical *ancing*, and stay away from activities in all forms of *owds*, gatherings, and avoiding gatherings that *involve* many people, as an effort to suppress the expansion of covid-19. Of course, teachers or students are required to adapt to these changes. Initially, the teaching and learning process only took place in the classroom, but now the all-digital teaching and learning process is not bound by space and time. Indirectly, the teacher must find creative ideas so that learning is still fun and able to achieve the existing goals.

The research conducted on the use of mobile phones in learning has also been widely carried out and reveals that mobile phone devices are very much needed in learning (Grewal et al., 2020). The use of mobile phones can significantly improve students' academic performance even though the frequency of use does not affect academic performance among male students and female students (Grewal et al., 2020; Han et al., 2019; May et al., 2018; Santhi et al., 2020). In addition, the use of conventional teaching materials causes the learning process to only take place in a monotonous manner and makes students passive and less focused on the teacher who is teaching (Husni, 2020). Based on the results of interviews with physics subject teachers, it showed that students who have smart-phones reach the range of 95%, but the high number of smart-phone users among students is not in line with the ability to utilize the use of smart-phones in the learning process.

One alternative that is believed to be able to overcome these problems, especially in physics learning was to optimize the use of technology and the use of more innovative teaching materials. Using smart-phones by considering the need for learning media and teaching materials in the form of student worksheets, this researcher focused on making student worksheet with a hyper-content approach. The use of the term hyper-content used in this student worksheet was adopted from the hyper-content learning design. Simbolon et al. (2021) explained that learning designed with hyper-content consists of modules, topics, and concepts. Topics are presented using text, video, images, graphics, and audio. The concept of material in this hyper-content-based student worksheet will be complemented by supporting materials linked to various interesting content such as on Google-Web, You tube, Google Drive, and Office 365. In addition, content in cyberspace that has been provided will then be accessed using a smart-phone with the help of the Quick Response Code (QR Code) scan application. Referring to the explanation above, it is hoped that this hyper-content-based student worksheet can be a solution to make students motivated in learning physics.

## Method

The type of research used is Research and Development (R&D) to produce a product in the form of a hyper content-based student worksheet. The procedure in this study adopts the development model proposed by Branch, namely the *ADDIE* model, namely (A) Analysis, (D) Design, (D) Development, (I) Implementation, and (E) Evaluation (Branch, 2009). The stages of the *ADDIE* development model are described as follows: (1) the analysis stage, the things that are done include observation, curriculum analysis, subject matter analysis and student worksheet analysis; (2) The design stage is the stage for designing in choosing physics learning tools, namely the student worksheet based on hyper content on temperature and heat material; (3) The development stage, the development stage is the production stage of hyper content-based student worksheets on temperature and heat materials; (4) The trial stage, which is at this stage a field trial is carried out on the student worksheet that have been developed; (5) The evaluation stage, what is done at this stage is the process of final revision of the hyper content-based student worksheet on temperature and heat material.

The research was conducted at SMA Muhammadiyah 1 Unismuh Makassar. The subjects in this study were 1 physics teacher and 13 students in class XI. The instruments used in this study were (1) validation sheets to support hyper content-based student worksheet validity data; (2) Questionnaire sheets for teacher and student responses to support the practicality of hyper content-based Student Worksheets; (3) a test to measure the effectiveness of the developed Student Worksheet. Some of the data analysis techniques used in this study are as follows.

*Analysis of the validity of student worksheet based on hyper content*

The validity data of the hyper content-based students worksheet conducted by the valuator is obtained through a validity test using the Gregory test as follows.

**Table 1.** Justify Model between Raters for Content Validity

| Rater 2 | | Rater 1 |
| --- | --- | --- |
| | 1-2 | 3-4 |
| 1-2 | A | B |
| 3-4 | C | D |

$$V_c = \frac{D}{A + B + C + D} \qquad (1)$$

s: Vc = content validity, A = two raters disagree, B = rater 1 agree, rater 2 disagree, C = rater 1 disagree, rater 2 agree, and D = two raters agree (Retnawati, 2016).

Expert Agreement on Content Validity Index is a comparison of the number of entries from the two experts in the category with strong relevance for all items. The 2x2 contingency table matrix shows that there are four categories of opportunities in the form of agreement between the two valuators' which can be described as follows.

a. If both valuators give the same score assessment on the same item with a score range of 1-2, then the relevance category is weak, symbolized by A.
b. If on the same item, valuator 1 gives an assessment of scores in the range of 3-4, while valuator 2 gives an assessment of scores in the range of 1-2, then the relevance category is strong and weak, symbolized by B.
c. If on the same item, valuator 1 gives a score assessment in the range of 1-2, while valuator 2 gives an assessment score with a range of 3-4, then the relevance category is weak, symbolized by C. If both valuators give the same score on the same item with a range of 3-4, then the relevance category is strong, symbolized by D.

The next step is to determine the value of the content validity coefficient based on the contingency of Table 1.

**Table 2.** Criteria of Content Validity

| Coefficient validity | Criteria |
|---|---|
| 0.80 – 1.00 | very good |
| 0.60 – 0.79 | good |
| 0.40 – 0.59 | midle |
| 0.20 – 0.39 | low |
| 0.00 – 0.19 | very low |

According to Deratama et al. (2022), Fulmer (2015), Hurralman et al. (2022), Suseno (2014), Susetyo (2015), and Taslidere (2016) a device is declared valid if the content validity price is above 0.5.

*Analysis of the practicality of Hyper-content-based student worksheets*

Validation of the practicality of student worksheets was measured using a response questionnaire consisting of 12 negative statements and 14 positive statements. The rating scale used was Likert scales with a scale of five consisting of more disagree, disagree, moderately agree, agree, and strongly agree. The assessment was carried out through administering a questionnaire to teachers and students. The entire assessment score obtained was then analyzed descriptively quantitatively with the following equation 2.

$$P(\%) = \frac{\sum X}{\sum X_i} x100 \tag{2}$$

Notes: P = total score in percentage, $\sum X$=the number of respondents' scores in one item, $\sum X_i$= the ideal number of scores in one item. The criteria for the interpretation of the questionnaire score can be seen in the table 3.

**Table 3.** Categorization of interpretation of Students' Response (Sari, 2017)

| Interval (%) | Category |
|---|---|
| 80 < X ≤ 100 | Very practical |
| 60 < X ≤ 80 | Practical |
| 40 < X ≤ 60 | Medium Practical |
| 20 < X ≤ 40 | Low Practical |
| 0 < X ≤ 20 | Not Practical |

*Analysis of the effectiveness of Hyper-content based student worksheets*

The effectiveness of using student worksheets based on hyper-content is measured based on the implementation of the worksheets produced in physics learning. analysis of the effectiveness of student worksheets using the N-Gain equation as follows.

$$g = \frac{(S_{post} - S_{pre})}{(S_{max} - S_{pre})} x100 \tag{3}$$

Notes: g = coefficient value of n-gain, $S_{post}$ = mean score on post-test, $S_{pre}$= mean score on pre-test, $S_{max}$ = maximum score. N-gain values are divided into three categories as shown in table 4.

**Table 4.** Category of N-Gain Coefficient (Meltzer, 2002)

| Coefficient interval | Category |
|---|---|
| (g) ≥ 0.7 | High |
| 0.3 ≤ (g) < 0.7 | Medium |
| (g) < 0.3 | Low |

## Result and Discussion

The results of this study are described based on the stages of the development model used.

*Analysis Stage*

This research begins with an analysis of development needs by considering aspects of learning which include analysis on aspects of curriculum, aspects of learning materials and aspects of learning media in this case Student Worksheets. with the learning conditions at SMA Muhammadiyah 1 Unismuh Makassar.

## .iculum Analysis

Curriculum analysis needs to be considered in developing student worksheets because through curriculum analysis activities it can be used to find out materials that require student worksheets. The curriculum applied at SMA Muhammadiyah 1 Unismuh Makassar is the 2013 curriculum which emphasizes students to be able to develop attitudes, knowledge and skills and implement them in everyday life to be able to solve problems. The following are the basic competencies and indicators in the syllabus used by SMA Muhammadiyah 1 Unismuh Makassar. In this study, researchers only focused on basic competencies 3.5 and 4.5, namely the teaching material of temperature and heat with details of basic competencies and indicators as Table 5.

In assigning tasks and activities in student worksheets, it is necessary to pay attention to the clarity of the basic competencies to be achieved (Octaviani, 2017). Therefore, in the preparation of student worksheets, a description of the basic competencies that will be used in developing student worksheets based on Hyper content is described, namely the basic competencies 3.5 and 4.5. The existence of Hyper content student worksheet is expected to be an alternative in achieving the indicators contained in the Basic Competencies. One of the interesting things contained in the Hyper content-based student worksheets is by providing students with lots of content so that students are not only fixated on one learning resource. but from various digital learning resources.

**Table 5.** Basic Competences and Indicators of Teaching Materials of Temperature and Heat Topics

| Basic Competences | | | Indicators of Teaching Materials | | |
|---|---|---|---|---|---|
| 3.5 | Analyzing the effect of heat and heat transfer which includes the thermal characteristics of a material, capacity, and heat conductivity in everyday life. | 3.5.1<br>3.5.2<br>3.5.3 | 1. Students can define the notion of temperature.<br>2. Students can explain expansion events in everyday life.<br>3. Students can analyze the effect of changes in the temperature of objects on the size of objects (expansion). | | |
| 4.5 | Designing and conducting experiments on the thermal characteristics of a material, especially related to heat capacity and conductivity, along with presentation of experimental results and their use. | 4.5.1<br><br>4.5.2<br><br>4.5.3 | 1. Students will be able to design experiments on the expansion of solids.<br>2. Students will be able to experiment with the expansion of solids.<br>3. Students can present changes in the shape of objects due to an increase in temperature. | | |

## Analysis of Teaching Materials

The analysis of teaching materials is carried out with the aim that the material presented in the Student Worksheet on Temperature and Heat material is not missed and arranged systematically. The material contained in the subject of temperature and heat is temperature and expansion, the relationship of heat to the temperature of objects and their forms, the black principle, and heat transfer by conduction, convection and radiation.

## Analysis of Students Worksheet

Student worksheets used by teachers at SMA Muhammadiyah 1 Unismuh Makassar were worksheets that only present experiments, there were no supporting materials, pictures that can attract students' interest and motivation in learning. Meanwhile, students need worksheets that have an attractive appearance and are equipped with supporting images so that students feel happy reading the worksheets and students need worksheets in simple and easy-to-understand language and are related to the real world or everyday life.

Based on the interviews conducted, it was obtained information that students have a lack of interest in the physics learning process and the use of technology such as cell phones in learning has also not been carried out

by teachers, even though cell phone users for students at SMA Muhammadiyah 1 Unismuh Makassar reach the range of 95%. Based on these problems, the researchers wanted to develop a hyper-content based Student Worksheet on temperature and heat material to assist teachers in the teaching and learning process so as to improve student learning achievement.

The student worksheets used by teachers in schools so far have been in the form of student worksheets that only present experiments without any supporting material. Presentation of pictures in student worksheets does not attract students' attention in learning. Meanwhile, one of the requirements to attract the attention of student learning is the availability of teaching materials that have an attractive appearance and are equipped with supporting images so that students feel happy reading the student worksheets.

Need assessment was also traced to the technique of presenting teaching materials that should use simple and easy-to-understand language and relate to events in students' daily lives. This statement is reinforced from the results of interviews conducted, it was obtained information that students were less interested in the physics learning process which had only used student worksheets which were monotonous and without variations in images and colors.

.hey also hope that physics teachers can use .nology media in physics learning as much as .ssible, such as mobile phones. because, so far, their physics teachers have never used the media in learning. Whereas, mobile phone users for students at SMA Muhammadiyah 1 Unismuh Makassar reached the range of 95%. Based on these problems, researchers want to develop student worksheets that use mobile technology media. One of them is a hyper-content-based student worksheet on temperature and heat material. The purpose of developing hyper-content-based student worksheets is to assist teachers in the teaching and learning process so as to increase student interest in learning which leads to increased student achievement.

## Design Stage

Based on the results of the analysis material that has been carried out, the process of designing or making student worksheets based on hyper-content on temperature and heat material is to adjust the basic competencies and indicators based on the 2013 curriculum. Student worksheets on temperature and heat material use A4 paper size. The font size used is 15 for the sub title and 13 for the content with the font type used is Arial with 1.5 and 1.0 spacing (according to the needs and neatness of the content). The mock-up design or student worksheet model based on hyper-content on the subject of temperature and heat is structured as follows:

## Introduction

This introductory section contains various information about teaching materials, such as the identity of subjects and sub-teaching materials, self-identity, learning objectives, and learning resources.

## Contents of teaching materials in hyper content-based worksheets

In the content section of the teaching materials, a description of the teaching materials is compiled which is equipped with questions, answers and various barcodes which of course contains online learning resources which can be in the form of teaching materials and videos, or Wikipedia. In this section, practical content can also be included.

## Evaluation

The evaluation section is filled with assignments and special evaluation questions for one meeting which can be accessed via barcode. The initial design of the product can be seen in the following flowchart in Figure 1.
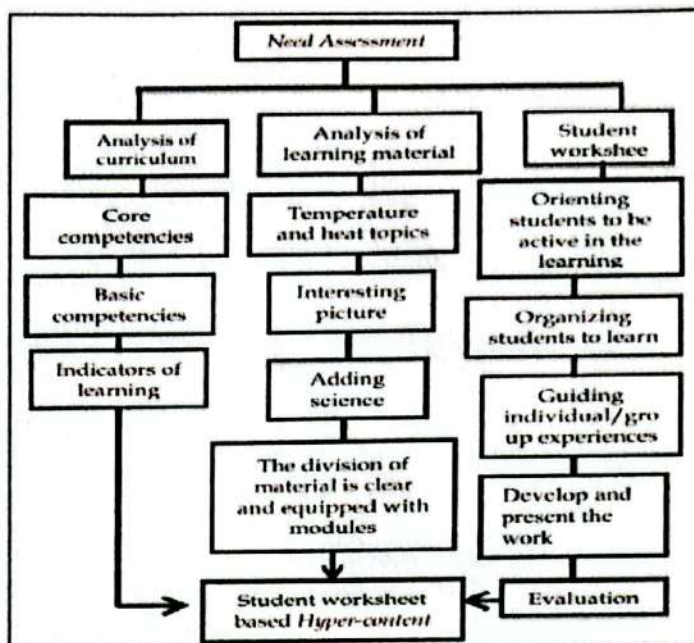


**Figure 1.** Flowchart or initial design chart of hyper content-based worksheets

## Development Stage

The next stage is making the development of student worksheets as a follow-up to the designs that have been carried out at the design stage. This development stage aims to produce student worksheets. At the development stage, student worksheets are developed by applying the initial product framework that has been created. The development of hyper content-based student worksheet products is made based on the Discovery Learning syntax. At this stage, learning tools in the form of teaching material modules, presentation media, evaluation questions and learning videos related to teaching materials are well prepared so that researchers can easily examine online learning resources about temperature and heat materials in the form of Wikipedia, online articles, websites Science Physics, Blog, and learning videos from You tube. Furthermore, the stages of preparing learning tools are carried out as follows.

1. Learning device storage stage with cloud system.
a) Teaching materials in the form of modules, presentation media are stored via Google Drive.
b) The learning videos are saved on the You tube video app.
c) The evaluation questions are entered in the Forms application in Office 365.

2. The QR Code Generator stage is carried out with the following steps.
a) Copy the URL address where teaching materials, videos, evaluation questions, Wikipedia, articles, websites, blogs, and other learning videos are stored.
b) Open the website address of the QR Code generator.

nput the URL address of online learning resources.
Save QR Code result.

3. Hyper content-based student worksheet development stage

The development of hyper content-based student worksheets in a structured manner contains the following information and contents of student worksheet

a) Cover

The next step is to make a simple student worksheet cover with an attractive color combination and image.



Figure 2. Cover of student worksheet

The cover of the student worksheet is on the first page and there is the subject title "Temperature and Heat".

b) Preface

Writing the introduction is very important because it is located on the very first page so that it will be the first part that the reader sees. The introduction is also equipped with an encouraging description to arouse the interest of students in particular to work on the student worksheets.



Figure 3. The view of preface page

c) Introduction for use

Instructions for using the student worksheet are very important because the Student Worksheet developed in the form of a hyper content-based student worksheet with the help of a QR code, it is necessary to write down how to use and access it so that there is no confusion in the use of the Student Worksheet.



Figure 4. The page view of Student worksheet usage instructions

d) The content of students worksheet

The content of student worksheets is arranged in the following order.
1) Title of student worksheet
2) Student worksheet identity (name of school, name of teacher, class, name of subject, sub-topic)
3) Student Identity
4) Learning Objectives
5) Learning resources and references, this section is equipped with a barcode for presentation media
6) The relevance of teaching materials in human daily life. In the relevance section, student worksheets are filled with descriptions, pictures, and barcodes in the form of learning videos from You tube
7) Fill in the teaching materials on the student worksheets. The contents of the student worksheets include not only descriptions of teaching materials but also questions and answers, as well as barcodes in the form of online learning resources (Wikipedia, websites, articles, etc.)
8) Trial (optional)
9) The end of the worksheet

At the end of the worksheet, students are facilitated with e-modules, assignments and online evaluation questions using barcodes so that students can directly evaluate their learning activities at one meeting.

**Figure 5.** Content of Students Worksheet

The student worksheets that had been developed were validated by two valuators before being implemented in the real class. The following were the results of expert validation on student worksheets as shown in table 6.

**Table 6.** The results of the Validation of the Student Worksheet by the Two Valuators

| Aspect of assessment | Percentage (%) |
| --- | --- |
| Format | 87.50 |
| Content | 96.90 |
| Language | 100.00 |
| Student worksheet benefits | 100.00 |
| Score average | 96.60 |

The results of analyzed validity of the hyper content-based student worksheet based on the Gregory test showed an agreement coefficient (r) of 0.98. This data shows that the developed hyper content-based Student Worksheet is valid with a high category. However, this worksheet that has been designed still needs to be revised in certain parts to be declared suitable for use. Similar research showed that hyper content-based worksheets developed in science learning have a high level of validity with a Gregory coefficient (r) of 1.00 with a mean score of 86.7% (Amin et al., 2020; Nurzaelani et al., 2020; Syarifudin, 2020).

*Implementation Stage*

At this stage, the researcher implemented a proper hyper content-based student worksheet based on the results of the validator's assessment. The implementation was carried out in class XI MIA 1 SMA Muhammadiyah 1 Unismuh Makassar which consisted of 14 students. The following was a diagram of the results of teacher and student responses in table 6 and table 7.

**Table 7.** Teacher's Assessment Response to Hyper-content-based Student Worksheets

| Rated Aspect | Mean Score (%) |
| --- | --- |
| Clarity of student worksheet | 100.00 |
| Compatibility of student worksheet Content with basic competencies | 95.00 |
| Visualization of student worksheet | 98.00 |
| Effective use of student worksheets | 95.00 |

**Table 8.** Student assessment responses to Hyper-content-based Student Worksheets

| Rated Aspect | Mean Score (%) |
| --- | --- |
| Visualization | 89.23 |
| Language | 86.54 |
| Content | 82.24 |
| Cover design | 81.28 |

Effectiveness data was taken based on the learning outcomes of students by conducting multiple-choice posttest and pretest tests and calculated using the n-gain test. The results of the n-gain analysis show that the coefficient of g obtained is 0.59 with a medium category.

*Evaluation Stage*

After the student worksheet was validated by the validator, then an evaluation is carried out on the developed student worksheet. based on the validation results, several validator notes were obtained for improving student worksheets. *First*, suggestions for improvement for the margin (Left) of student worksheets to be given a little space with the aim of making it easier for students when filling out student worksheets. *Second*, suggestions for improvement are changing one of the video content and dividing the material (presentation media) for each sub-topic with the aim of making it more effective when used by students.

Furthermore, the practicality test phase of the worksheet obtained input from the teacher in the form of a statement from the teacher that the Hyper-content-based student worksheet is suitable for use as a digital-based worksheet. In addition, the worksheet can be used as a guide for teachers when viewed from the aspect of presentation, content, language and use of the worksheet. The suggestion from the teacher is that the worksheet should be enriched with practice questions.

## Conclusion

Based on the results of research and discussion, it can be concluded that, it can be concluded that the Hyper-content-based student worksheets on temperature and heat topics developed were very suitable for use at SMA Muhammadiyah 1 Unismuh Makassar. This can be seen from the average percentage obtained from the results of content validation, which is 96.0% with Very Eligible criteria. Furthermore, the percentage of physics teacher and student responses to the resulting Hyper-content-based student worksheets was positive with the percentage score obtained was 100.0% with very practical criteria. Meanwhile, the response of students to student worksheets with very practical criteria was 84.37%. Furthermore, the effectiveness of Hyper-content-based student worksheets in learning physics on the topic of temperature and heat was obtained at 0.59 with a fairly effective category. The results of this study have implications for the preparation of a debriefing model in students' physics learning at the high school level that can facilitate digital-based learning. However, this research on the development of teaching materials is still limited to student worksheets with material on temperature and heat. Therefore, this research can be used as a reference in further research related to the preparation of appropriate learning models and how to develop similar student worksheets on other topics.

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