

Developing Handouts Accompanied by Practice Questions on Inheritance Material for SMP/MTs

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Abstract

To make it easier to present the material, one of the materials that can be developed is a handout. This research aims to produce handouts accompanied by practice questions on inheritance material for class IX SMP/MTs. This research was conducted at MTsN Lembah Gumanti in March of the 2014/2015 academic year. This research includes development research, namely the development of handouts accompanied by practice questions with modified 4-D models consisting of the define, design, and developing stages. The data is in the form of primary data consisting of scores from filling out validity and practicality questionnaires by teachers and students. Data were analyzed using descriptive analysis in the form of percentages. The handouts produced were categorized as very valid, both in the didactic, construction, and technical categories with a handout validity value of 89.10%. The resulting handout was categorized as very practical according to the teacher with a score of 89.30%, and according to students with a score of 89.6%, it was categorized as very practical. So, it can be concluded that this research has produced handouts accompanied by practice questions that are very valid and very practical so they are suitable for use in the learning process.

Keywords: accompanied, handouts, practice questions

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Introduction

Education is the process of producing human resources who have a system of values and culture in a better direction, including in the formation of personality, skills and intellectual development. Improving the quality of education cannot be separated from the role of teachers. The duties and roles of teachers as educators are very complex, starting from delivering lesson material to achieve learning goals to creating student learning experiences. In the learning process, students are required to understand the concepts of material, as is the case in biology learning. Apart from that, in biology learning the material is also quite extensive so students' interest in reading is reduced. Therefore, teachers as facilitators need to provide teaching materials that are easy for students to understand according to the indicators to be achieved.

According to (Lufri, 2007) biology, subject matter or materials are facts, concepts, principles, and theories. Apart from that, in the learning process, students are not only required to be able to memorize study material. Students are also required to understand concepts in depth to achieve predetermined learning targets. Teachers are required to be able to deliver learning material and also prepare the tools needed to achieve learning objectives. The process of learning activities requires teaching materials to support the learning activities. In this case, teachers are required to be able to develop their teaching materials because the available teaching materials are often inappropriate or unsuitable for students. There are several reasons for incompatibility, for example: social environment, geography, culture, and student characteristics (Depdiknas, 2008).

According to the National Center for Competency-Based Training (2007) in Prastowo (2011: 16-17), teaching materials are all forms of materials used to assist teachers and instructors in carrying out the learning process in the classroom. The materials in question can be written or unwritten exercises, for example, textbooks, modules, student worksheets (LKS), handouts, and so on. Based on the results of the author's interview with Mrs. Susi Yanti M, S.P, Biology teacher at MTsN Lembah Gumanti Alahan Panjang, 15 October 2013, it is known that the LKS in schools cannot represent all learning objectives and the presentation of the material is not complete, so teachers have to use several books and teaching materials. suggested by the MGMP team (subject teachers' discussion). Apart from that, not all students can own textbooks independently and the books available at school are not balanced with the number of students there. Meanwhile, the ratio or number of textbooks available in schools according to the National Education Standards Agency, (2007: 5) concerning Regulation of the Minister of National Education number 41 of 2007 concerning textbooks, namely the ratio of textbooks for students is 1:1 per subject. This makes it difficult for students to study at home because they don't have a handbook that they can study at home. Many types of teaching materials can be designed and used to help the teaching and learning process, one of which is handouts.

The results of the initial observation questionnaire on student responses to teaching materials revealed that 80% of students had handbooks or teaching materials in biology learning. 85% of students like reading books or biology teaching materials, but 75% of students have difficulty understanding the material presented in books or biology teaching materials. The difficulties experienced by 75% of students include understanding the words and practice questions used in the books or biology teaching materials used. 95% of students understand the lesson better by using practice questions. 80% of students stated that they did not have teaching materials in the form of handouts on inheritance material, so 95% of students agreed that the teaching materials used were presented in the form of handouts accompanied by practice questions.

The material that is quite difficult for students is the material on inheritance of traits, because in this material there are calculation questions. Explanations of example questions and practice questions in the teaching materials used are difficult for students to understand. It can be

seen from the average daily test results for class IX.A students 71.1, class IX.B 74.5, class IX.C 49.16, class IX.D 50.2 in the 2013/2014 academic year, which is still far below the minimum completeness criteria, namely 75. Apart from that, calculation questions regarding inheritance of traits are always present in national exams. To make presentation easier regarding that material, then one of the teaching materials that can be developed is handout with practice questions. The results of research conducted by Yunita (2013: 64) entitled development of handouts with a magazine display on excretion system material for class 91.80 by teachers which can be categorized as very practical. Research conducted by Endrya (2010: 59) entitled development of interactive compact disk (CD) media in biology learning on inheritance material in grade IX junior high schools has a validity level of 80.40% which is categorized as valid, while teacher practicality is 77.08% which is categorized as practical and 81.08% of students' practicality is categorized as very practical. From this description, it can be seen that the teaching materials developed can facilitate understanding of the material presented. Based on the description above, the author conducted research with the title "Development of Handouts with Practice Questions on Inheritance Material for SMP/MTs".

Methodology

This type of research is development research. This research produced handouts accompanied by valid and practical practice questions on inheritance material. The development of learning tools in this research adapts the development of 4-D Model tools proposed by Thiagarajan, Semmel and Semmel. The development process consists of four stages, namely define, design, develop, and disseminate. Because the results of this research were not distributed to other agencies/institutions (other than the research site), only three stages were used, namely up to the development stage.

Results

Biology handouts accompanied by practice questions on the inheritance of traits were created in three stages, namely the define, design and develop stages. From these stages the following results were obtained:

Define stage (definition):

Front end analysis

The results of the front end analysis that the author has carried out at MTsN Lembah Gumanti are the lack of student interest in learning because the teaching materials used, namely worksheets, are difficult for students to understand because the description of the material is too short, the worksheets used cannot represent all learning objectives, and the textbooks available in schools do not match the number of students as evidenced by the results of research surveys in the field that very few students bring textbooks when studying.

Student analysis

The results of the analysis of students show that class IX students at MTsN Lembah Gumanti are 13-14 years old. At this stage students are at the concrete operational stage. According to Piaget in Budiningsih, (2005: 38) is a child are able to think abstractly, logically, draw conclusions, interpret and develop hypotheses. Based on students' responses to the teaching

materials obtained at school, students have difficulty understanding the material on inheritance of traits because the description of the material in the existing teaching materials is too concise.

Task analysis

Task analysis is carried out to detail the teaching material in outline form. This analysis obtained the following results :Analyze the content structure : Based on the KTSP curriculum for Biology at SMP/MTs class IX level, the competency standards, basic competencies and indicators of inheritance of traits are obtained as follows; Competency standards: Understanding the survival of living things; Basic competency: Describe the concept of inheritance of the characteristics of creatures and describe the process of inheritance and the results of inheritance of characteristics and their application; Indicators in inheritance material are as follows : Explain the concept of genetic material; Explain the structure of chromosomes and their functions; Explain the types of chromosomes; Explain the terms in inheritance of traits; Explain Mendel's law of inheritance; Explain the process and results of monohybrid crossing; Explain the process and results of intermediate monohybrid crosses; Explain the process and results of dihybrid crossing; Explain the formula for predicting offspring and the benefits of crossing.

Concept analysis: The main concepts in the material on inheritance are as follows: a) Understanding genetic material, b) Understanding genes, c) Definition of chromosomes, d) Chromosome structure, e) Various types of chromosomes, f) Terms in inheritance of traits, g) Definition of monohybrid and dihybrid crosses, Formulation of learning objectives; The learning objectives for the inheritance material are as follows: a) Students are able to explain the meaning of genetic material through handouts, b) Students are able to explain the meaning of genes through handouts, c) Students are able to explain the meaning of chromosomes through handouts, d) Students are able to explain the structure of chromosomes through handouts, e) Students are able to explain the function of the structures that make up chromosomes through handouts. f) Students are able to compare 2 (two) types of chromosomes based on their function through handouts. g) Students are able to compare the 4 (four) types of chromosomes based on the location of the centromere through the handout, h) Students are able to explain the terms in inheritance of traits through handouts, i) Students are able to explain why Mendel used peas in his experiments through handouts, j) Students are able to explain the theory from the results of Mendel's experiments (Mendel's law I and Mendel's law II) through handouts, k) Students are able to explain monohybrid crosses through handouts, l) Students are able to explain examples of monohybrid crosses through practice questions, m) Students are able to explain handout intermediate monohybrid crosses, n) Students are able to explain examples of intermediate monohybrid crosses through practice questions, o) Students are able to explain dihybrid crosses through handouts, p) Students are able to explain examples of dihybrid crosses through practice questions, q) Students are able to explain the formula for predicting offspring through handouts, r) Students are able to benefit from cross-talk through handouts.

Design stage

At this design stage, handouts are designed to make it easier for students in the learning process. In this handout there are 3 meetings. This handout was made using the Microsoft Power Point application, the writing used was comic sans ms with line spacing 1.5 size 12. According to Rustan (2008: 43) comic sans ms is a casual script typeface. Script letters resemble hand strokes done with a pen, brush or sharp pencil. The impression it creates is personal and intimate. The spacing size of 1.5 makes it easier for students to read the type in the material presentation (does not tire the eyes). Apart from that, the spacing size of 1.5 makes it easier for students if they want to underline or mark things they consider important. The results of this stage of research are as follow: a. Cover : The cover of the handout accompanied by practice questions on the material on

inheritance of traits is light blue. Based on the results of the student characteristics analysis questionnaire, it was found that most students like the color blue, in line with what Wardhani (2010: 3) stated that choosing light blue can help concentration. The shape of the cover can be seen in Figure 1:



Figure 1. Handout cover

List of contents: The table of contents contains instructions for students to view the lesson material and see the desired page on the handout. The form of the table of contents can be seen in Figure 2.

DAFTAR ISI	
Handout Pertemuan Pertama	i
A. Konsep pewarisan sifat	2
1. Pengertian materi genetik	2
2. Pengertian gen	2
3. Pengertian kromosom	3
4. Struktur kromosom	3
5. Macam-macam kromosom	4
6. Istilah-istilah dalam pewarisan sifat	6
7. Hukum penurunan sifat Mendel	9
Latihan soal	10
Handout pertemuan kedua	13
B. Proses dan Hasil pewarisan Sifat	14
1. Persilangan monohibrid	14
a. Persilangan monohibrid dominan penuh	14
b. Persilangan monohibrid intermediet	17
Latihan soal	20
Handout pertemuan ketiga	23
2. Persilangan Dihibrid	24
3. Beberapa rumus untuk memprediksi keturunan	27
4. Manfaat ilmu pewarisan sifat	28
Latihan Soal	29
Rangkuman	32
Uji Kompetensi	33
Daftar pustaka	

Figure 2. Table of Contents in Handout

Home page: The first page of the handout contains competency standards, basic competency indicators and learning objectives which are explained in detail in the handout. SK, KD, I and learning objectives are created for each meeting with a different design. The author did this to make it easier for students to differentiate between the first, second and third meetings as

well as to act as a divider between the material at each meeting. The shape of the page can be seen in Figure 3.

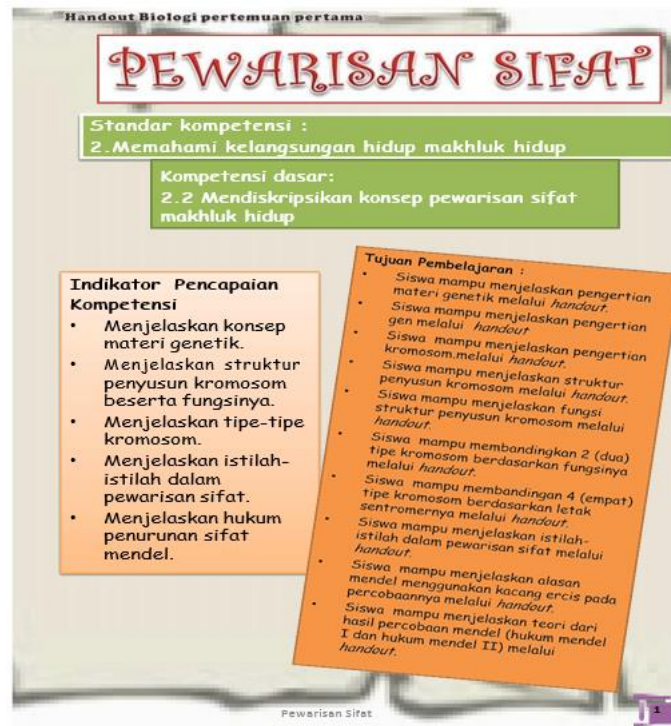


Figure 3. Handout Home Page

Material description: This page contains material on inheritance of traits in accordance with learning objectives. The design for the material section, the author chose a pastel coloreds background, according to the book Color Harmony Pastel in Binus (2011: 20) that pastel colors can produce a calming mood. The form of material description can be seen in Figure 4:



Figure 4. Description of material in the handout

Problem example; This page contains two example questions with the solutions explained in stages, which are expected to help students understand the material. In this example question,

there is an image that matches the original form which is expected to motivate students to learn using the handout. The form of an example question can be seen in Figure 5:

Handout Biologi pertemuan kedua

1

Diketahui : Bunga pukul empat warna merah = MM
Bunga pukul empat warna putih = mm

Ditanya :
Jawab :



P : merah >×< putih
MM >×< mm
Gamet : M m

F1 : Mm
Untuk mendapatkan F2, maka disilangkan F1 sebagai berikut ini.

F2 : F1 >×< F1
P2 : Mm >×< Mm
Fenotip: merah muda >×< merah muda



Keterangan:
rasio fenotip
untuk
persilangan
dihybrid
intermediet
adalah 1:2:1

F2 :

	M	m
M	MM	Mm
m	Mm	mm

genotip : 1 MM : 1 Mm : 1 mm
fenotip : 1 merah : 2 merah muda : 1 putih

Pewarisan Sifat

Figure 5. Example of questions in the handout

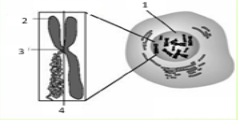
Exercise; This page contains 10 objectives and 5 essay questions for the first meeting. 5 objective questions and 5 essay questions for the second and third meetings. The practice questions in the handout are expected to help students understand the concept. The form of practice questions can be seen in Figure 6.

Handout Biologi pertemuan pertama

Latihan soal

A. Berilah tanda silang (x) pada huruf a, b, c atau d pada jawaban yang benar!

- Bagian sel yang berperan dalam pewarisan sifat adalah....
a. Nukleus
b. Ribosom
c. gen
d. Inti sel
- Benang-benang halus yang memadat dan memendek pada pembelahan sel yang berfungsi sebagai pembawa informasi genetik kepada keturunannya adalah
a. Alel
b. Genom
c. kromosom
d. Hereditas
- Perhatikan gambar berikut!



no pada gambar di atas yang menunjukkan sentromer adalah....
a. 1
b. 2
c. 3
d. 4

- Selubung pembungkus kromonema adalah....
a. Sentromer
b. Lengan kromosom
c. Matriks
d. Telomer
- Bentuk kromosom jika sentromernya terletak ditengah-tengah antara kedua lengan adalah....
a. submetasentrik
b. akrosentrik
c. telosentrik
d. Metasentrik

Pewarisan Sifat

Figure 6. Practice questions in the handout

Summary: This page contains a summary of the inheritance material in the handout along with practice questions. The form of the summary page can be seen in Figure 7:

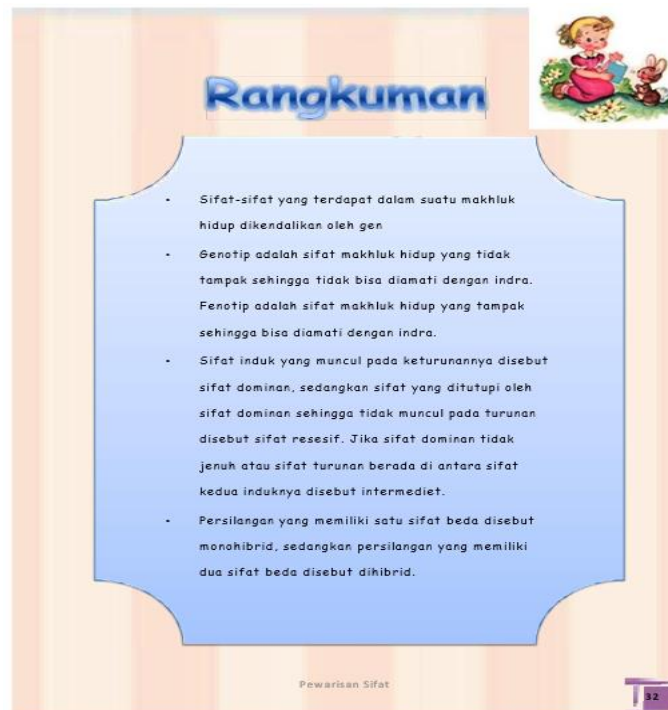


Figure 7. Summary in Handout

Competency test: This page contains questions in the form of 20 objective questions to test students' understanding of the inheritance material as a whole. The form of the competency test can be seen in Figure 8.



Figure 8. Competency Test Questions in the Handout

Bibliography: On this page displays reference sources in progress handouts. The form of the bibliography can be seen in Figure 9.



Figure 9. Bibliography in Handout

Develop stage (development)

This development stage is to produce learning tools that have been revised based on expert advice. This stage includes:

Handout validation accompanied by developed practice questions

Table 1. Handout Validity Results

Assessment aspect	Validity value	Criteria
Didactic requirements	90.50	Very valid
Construction requirements	86.80	Very valid
Technical requirements	90	Very valid
Total	267.30	
Average	89.10	Very valid

From Table 4 it can be seen that the average results of handout validation accompanied by practice questions show a result of 89.10% with a very valid category. This means that the handouts produced are good and can be used in the learning process. Handout validation with practice questions is the development stage. The handout accompanied by the resulting practice questions has been revised according to the validator's suggestions. The suggestions for revisions made can be seen in Table 2. The results of the handout validation accompanied by practice questions on the inheritance material can be seen in Table 2.

Table 2. Validator Suggestions for Handout Revision

Validator name	Validator suggestions	Information
Drs. Sudirman	1. 1. Contrast the title on the cover 2. 2. Add images to the example questions to make them interesting 3. 3. The choice of color in the sample question results is more contrasting 4. 4. Pay attention to the page setup for 5. binding	Already repaired
Melya Wati, M. Si	1. 1. Replace competency test question no. 5 2. 2. Correct question no. 11, option 3. a B C D 4. 3. Improve writing genotype symbols and reading phenotype 5. 4. Match the competency test questions with 6. indicators on the syllabus	Already repaired
Susi Yanti, M. SP	1. 1. Mendel's laws are not in the handout. 2. 2. Simplify how to find practice questions 3. 3. Add example questions/practice questions about 4. man	Already repaired

Practicality of handouts accompanied by practice questions

Handout practicality results accompanied by practice questions by the teacher

The results of the practicality of this handout with practice questions can be seen in Table 3:

Table 3. Handout Practicality Test Results by Teachers

Assessment aspect	Practicality value (%)	Criteria
Ease in	92	Very practical
Use	96	Very practical
Benefit	80	
Efficient learning time	268	Practical
Amount	89.30	

The table shows that the average practicality test results for handouts with practice questions are 89.3% in the very practical category. Based on these criteria, the handout with practice questions developed is very practical in terms of ease of use, benefits and efficiency of learning time. 2) Handout practicality results accompanied by practice questions by students. The results of the practicality of the handout accompanied by practice questions can be seen in Table 7 with detailed scores can be seen in Appendix 8.

Table 7. Handout Practicality Results by Students

Assessment aspect	Mark	Criteria
Ease in	practicality (%)	Very practical
use	85.10	Very practical
Benefit	92.60	Very practical
Time efficient	90.70	
learning	268.80	Very practical

From the table above, it can be seen that the results of the practicality questionnaire test by students were an average of 89.50% with very practical criteria. Based on these criteria, the handout with practice questions is very practical in terms of ease of use, benefits and efficient learning time.

Discussion

Validity of handouts accompanied by practice questions

The results of the handout validation questionnaire analysis are accompanied by practice questions by lecturers and teachers based on aspects of didactic requirements, construction and technical requirements. From the results, the validity of the handout with an average value of 89.1% is categorized as very valid. This validity test aims to see the suitability of the handout with the applicable curriculum, the correctness of the concepts and the accuracy of the writing in the handout accompanied by practice questions. Judging from the didactic requirements with a validation result of 90.5%, it is categorized as very valid, this means that the material refers to the applicable curriculum, in accordance with the SK, KD to be achieved. This is in line with the

opinion of (Sustainable, 2013), who states that teaching materials are prepared systematically which allows students to learn which is designed according to the applicable curriculum. Apart from that, according to (Lestari, 2013), the didactic requirements for handouts can support students' understanding of concepts, according to (Lestari, 2013), the characteristics of students from different backgrounds will be greatly helped by the presence of teaching materials so that they can be studied at their own pace, as well as a tool for evaluating learning outcomes because At the end of each study there is an evaluation.

When viewed from the handout construction requirements accompanied by practice questions with a validity value of 86.8%, it is categorized as very valid. This means that the handouts accompanied by practice questions already have descriptions of SK, KD, indicators that are easy to understand, have clear learning objectives, use simple sentences, are clear and easy to understand. The handout uses sentences that comply with good and correct Indonesian language rules. The handouts already have a sequence according to the student's ability level. Judging from the technical requirements, a validity value of 90% is categorized as very valid. This means that the handouts accompanied by practice questions have an attractive appearance using pictures, the type of letters used are correct and clear and the pictures in the handouts are clearly observable and can provide information so as to increase students' interest in reading. Student interest will arouse if the teaching materials used are in accordance with student needs. In accordance with Sadjiman's opinion in (Djamarah, et al, 2010) that teaching materials that suit students' needs will motivate students over a certain period of time. Overall, this data shows that the handout with practice questions has been tested and declared very valid by the validator so that it can be used as learning material. Good teaching materials must be in accordance with the applicable curriculum, use simple and precise language, have an attractive appearance so that they meet didactic, construction and technical requirement. Practicality of handouts accompanied by practice questions. Handouts accompanied by practice questions that had been declared valid by lecturers and teachers were given to 15 class IX students and 1 teacher at MTsN Lembah Gumanti to test their practicality:

Practicality of handouts accompanied by practice questions by the teacher

The results of the practicality test by 1 teacher at MTsN Lembah Gumanti showed that the handout with practice questions with an average of 89.3% was categorized as very practical. The practicality test of the handout accompanied by practice questions consists of 3 aspects, the convenience aspect, the benefits aspect and the efficiency aspect. Based on the criteria obtained from the aspect of ease of use of handouts accompanied by practice questions, an average score of 92% was obtained, which is included in the very practical category. The teacher thinks that the use of letters and writing in the handout is easy to understand. Handouts can be used by students individually and in groups. Apart from that, the handouts include clear concepts and images so that they can help students in the learning process. According to (Lestari, 2013), the function of teaching materials for teachers is to direct all their activities in the learning process as well as being the substance of competencies that are explained to students.

In the practicality test benefit aspect, the average score is 96% with very practical criteria. Handouts supported by pictures can help students understand the concepts of the subject matter, practice questions in the handouts can be used as measuring tools to determine the level of student understanding and teacher explanations that are not clear can be studied again in the handouts so that the handouts support the teacher's role as a facilitator. Judging from the aspect of learning time efficiency, the practicality test with an average score of 80% is categorized as practical. This shows that handouts accompanied by practice questions are more efficient in learning, students can use handouts repeatedly and students can work on practice questions at the right time. According to (Prastowo, 2011), the function of teaching materials for teachers is to save teachers'

time in teaching, change the teacher's role from a teacher to a facilitator, improve the learning process to be more effective and interactive, as a teacher's guide, and as a tool for evaluating achievement or mastery of results. Study.

Practicality of handouts accompanied by practice questions by students

Respondents who filled out the practicality test questionnaire were 15 class IX.A students at MTsN Lembah Gumanti. Data analysis of practicality test results by the students found an average score of 89.60% in the very practical category. This means that overall handouts are in demand, because they make it easier for students to understand the material on inheritance and are very practical to use as teaching materials. The aspects seen from this practicality test consist of 3 aspects, namely aspects of ease of use, benefits and aspects of efficiency. Judging from the aspect of ease of use, the average was 85.1% with respondents categorized as very practical. This is because the handout uses clear fonts and writing, the handout uses simple and easy to understand language, the handout is accompanied by practice questions that suit one's own abilities because the parts of the handout are arranged systematically and clearly, and the handout can be used in individual and individual learning. group, in line with what (Prastowo, 2011) said that teaching materials are used as the main media in the individual learning process.

Judging from the benefits aspect, the average is 92.60% in the very practical category. This means that the handouts are accompanied by practice questions containing material that is easy to understand. The concepts presented in the handout are in accordance with the learning indicators. The practice questions contained in the handout help students understand the concept of the material so they are motivated to learn. Presenting images in handouts can help students discover the concept of the material. Evaluation in handouts can measure students' abilities in achieving learning objectives. And teachers' explanations that are not clear can be studied again by using handouts in learning, which has several benefits, including making it easier for students in the learning process and filling in material deficiencies. Judging from the aspect of time efficiency with an average of 91.10% which is included in the very practical category. This is because handouts are more efficiently used in the learning process and students can work on practice questions with the available time. From the overall validity and practicality test results, it can be stated that the handouts are categorized as very valid by lecturers and teachers and categorized as practical by teachers and students. This shows that the handouts with practice questions are practical and can be used according to students' abilities, have an attractive appearance and can help learning more effectively.

Conclusion

Based on the research that has been carried out, a handout product was produced accompanied by practice questions on inheritance material which is very valid with a validity value of 89.10% and very practical with a value of 89.30% according to the teacher, 89.60% according to the students.

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