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**ANALYSIS OF ELIGIBILITY AND USEFULNESS BIOLOGY STUDENTS’ WORKSHEET ON BIOLOGICAL TECHNOLOGY INNOVATION TOPIC IN CLASS X**

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**ABSTRAK**

Penelitian ini bertujuan untuk menganalisis kelayakan, kelengkapan komponen, dan kebermanfaatan LKPD, serta aktivitas belajar siswa dengan menggunakan LKPD. Penelitian ini merupakan penelitian kualitatif yang dilaksanakan melalui studi kasus dan studi dokumen. Hasil kelayakan dan kelengkapan komponen LKPD diperoleh berdasarkan angket kelayakan dan kelengkapan komponen LKPD yang disusun berdasarkan indikator yang ditentukan, hasil kebermanfaatan LKPD diperoleh melalui angket respon siswa dan guru, dan hasil aktivitas belajar siswa diperoleh melalui observasi aktivitas belajar siswa berdasarkan pendekatan *Understanding by Design* (UbD). Hasil menunjukkan bahwa kelayakan LKPD berada dalam kategori kurang layak dengan skor 50, kelengkapan komponen LKPD dalam kategori lengkap dengan skor 80, kebermanfaatan LKPD bagi siswa dalam kategori bermanfaat dengan skor 67,55, kebermanfaatan LKPD bagi guru dalam kategori bermanfaat dengan skor 78,55, dan aktivitas belajar siswa dengan menggunakan LKPD dalam kategori tidak aktif dengan skor 5,84.

**ABSTRACT**

This study aims to analyze the eligibility, completeness, and usefulness of student worksheets, and student learning activities using student worksheets. This research is a qualitative study through case and document studies. The results of the eligibility and completeness of student worksheet components were obtained based the eligibility and completeness questionnaire with the specified indicators. The results of the usefulness of student worksheet were obtained through student and teacher response questionnaires. The results of student learning activities were obtained through observations of student learning activities based on the Understanding by Design (UbD) approach. The results indicated that the eligibility of student worksheets was in the less eligible category with 50 score, the completeness of student worksheet components in the complete category with 80 score, the usefulness of student worksheets for students in the useful category with 67,77 score, the usefulness of student worksheets for teachers in the useful category with 78,55 score, and student learning activities using student worksheets in the inactive category with 5,84 score.

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**INTRODUCTION**

The average science score of Indonesian students based on data obtained by PISA in 2022 is 366, with Indonesia ranked 67th out of 81 participating countries. The science literacy results have decreased from 2018, where the score was 379 (OECD, 2023). These results indicate that Indonesian students' success in science literacy is in the low category. Low literacy skills can be influenced by several factors, such as the use of student textbooks, student misconceptions in determining the relationship between concepts, unconceptualized learning, low interest in reading, learning environment, human resources, and school management (Suparya, 2022). One way to enhance students' science skills is through learning activities. These activities are a sustainable part of the learning process. A teacher must consider several elements when planning these activities, including learning objectives, readiness, supporting situations, interpretation, response, consequences, and reactions to failure. Among these elements, supporting situations are particularly important. The situation being referred to is one that can facilitate learning activities. This encompasses locations, equipment, instructional materials, and learning resources (Jufri, 2017).

Teaching materials are the contents of the subjects delivered to students during the learning process. Teaching materials play an important role in supporting the learning process. There are five types of teaching materials, including Student worksheets. Student worksheets can facilitate learning activities and promote effective interactions between teachers and students, thereby increasing student engagement and improving learning outcomes. These worksheets contain tasks with clear instructions and steps for students to complete (Azmi, 2018).

The purpose of using student worksheets is to improve and support the learning process in achieving indicators and competencies in accordance with the curriculum. Additionally, it assists teachers in achieving learning objectives. There are several functions of student worksheets in the learning process, including as teaching materials that activate students and minimize the role of educators. Additionally, worksheets can make it easier for students to understand the material by presenting concise tasks. Student worksheets have several benefits, including facilitating student learning, providing character values to students, disciplining students in completing school assignments, improving students' critical thinking skills, helping students recognize their environment, providing students with motivation and self-confidence, and improving students' learning outcomes (Sari, 2023).

Teachers must possess a high level of knowledge and skill in creating student worksheets to ensure that they meet the criteria for basic competencies, indicators, objectives, materials, and evaluation of student understanding achievement (Istiqomah, 2021). According to Article 6 of Permendikbud No. 8 of 2016, BSNP assesses the eligibility of textbooks or non-textbook lessons based on their content, language, presentation, and graphics. Student worksheets should include all Competency Standards (SK) and Basic Competencies (KD) in accordance with the Content Standards (SI), presented in an interesting and standardized language, and accompanied by attractive and appropriate illustrations. However, the merdeka curriculum does not include KI and KD terms. Instead, it focuses on Learning Outcomes (CP) and Learning Objectives (TP).

The student worksheet should be systematically prepared as teaching material, displaying a comprehensive overview of the competencies that students must master and use in the learning process. The content should include knowledge (facts, concepts, principles, and procedures), skills, and attitudes (Prastowo, 2015). Furthermore, the current merdeka curriculum utilizes differentiated learning based on the desired learning outcomes. The learning outcomes (CPs) are based on the theory of constructivism and the 'Understanding by Design (UbD)' approach developed by Wiggins and Tighe. According to Wiggins and Tighe, understanding can be demonstrated through six abilities: explanation, interpretation, application, perspective, empathy, and self-reflection (BSKAP, 2022). Therefore, the student worksheet should be able to improve at least these six abilities.

**RESEARCH METHODS**

This research is a type of qualitative research that aims to comprehend social issues based on detailed and complex real conditions. The subject of this study are research instrument validator, researcher, grade X biology teachers, three class of grade X students, and observers.

**Research Procedure**

The data were collected through questionnaires, observations, interviews, and documentation. The assessment of the eligibility and completeness of the student worksheet components was conducted by researchers, and the assessment of the usefulness of student worksheets was carried out by students in grades X-1, X-8, and X-10, as well as biology teachers in grade X. The questionnaire employed was a closed questionnaire with a predetermined number of items and answer choices. Observations were conducted in classes X-1, X-8, and X-10 to obtain data related to student learning activities with the assistance of student worksheets.

**Data Analysis**

Data analysis for the eligibility of student worksheets using a Likert scale ranging from 1 to 4, with the criteria being uneligible, less eligible, eligible, and very eligible. The percentage is calculated using the following formula.

Table 1. Eligibility criteria for student worksheet

|  |  |
| --- | --- |
| **Interval** | **Classification** |
| > 81,25 - 100 | Very Eligible |
| > 62,5 – 81,5 | Eligible |
| > 43,75 – 62,5 | Less Eligible |
| 25 – 43,75 | Uneligible |

Data analysis for the completeness of the student worksheet components employs a Guttman scale, which assigns a score of 1 if the components in the indicator are included in the student worksheet and a score of 0 if the activities in the indicator are not included in the student worksheet. The percentage is calculated using the following formula.

Table 2. Student worksheet components completeness criteria

|  |  |
| --- | --- |
| **Interval** | **Classification** |
| > 50 - 100 | Complete |
| 0 - 50 | Incomplete |

Data analysis used to determine the level of usefulness of student worksheets uses a Likert scale, specifically scoring 4 for the answer "always," 3 for "often," 2 for "sometimes" and 1 for "never". The percentage is calculated using the following formula.

Table 3. Criteria for student worksheet usefulness

|  |  |
| --- | --- |
| **Interval** | **Classification** |
| > 81,25 - 100 | Very Eligible |
| > 62,5 – 81,5 | Eligible |
| > 43,75 – 62,5 | Less Eligible |
| 25 – 43,75 | Uneligible |

Data analysis used to determine student learning activities uses a Guttman scale, namely a score of 1 if the activity in the indicator is carried out and a score of 0 if the activity in the indicator is not carried out. The percentage is calculated using the following formula.

Table 4. Criteria for student learning activities

|  |  |
| --- | --- |
| **Interval** | **Classification** |
| > 50 - 100 | Active |
| 0 - 50 | Passive |

**RESULT AND DISCUSSION**

**Eligibility of Student Worksheet**

The results of the research indicate that the eligibility value of biology student worksheets on biological innovation and technology topic is 50, in the less eligible category. The eligibility value of the student worksheet was obtained through an assessment using an eligibility questionnaire containing statements that had been validated through a process of expert review. The eligibility of student worksheets is assessed from indicators of content, language, presentation, and graphical eligibility. The research data regarding the eligibility of student worksheets can be seen in table 5.

Table 5. Student Worksheet Eligibility Assessment Results

|  |  |  |  |
| --- | --- | --- | --- |
| **No** | **Indicators of Assesment** | **Score** | **Classification** |
| **Content Eligibility** | | | | |
| 1 | Suitability of content with learning outcomes (CP) | 25 | Uneligible |
| 2 | Suitability of biological technology innovation topic on student worksheets with TP | 25 | Uneligible |
| 3 | The depth and breadth of explanation of biological technology innovation topics on student worksheets support TP | 25 | Uneligible |
| 4 | Suitability of questions to the demands of TP | 100 | Very Eligible |
| 5 | Accuracy of concepts and definitions in student worksheets | 100 | Very Eligible |
| 6 | Accuracy of examples and issue in student worksheets | 100 | Very Eligible |
| **Linguistic Eligibility** | | | | |
| 7 | Simplicity of language used in student worksheets on biological technology innovation topic | 25 | Uneligible |
| 8 | The spelling used refers to PUEBI | 25 | Uneligible |
| **Presentation Eligibility** | | | | |
| 9 | Concepts are presented coherently from simple to complex | 100 | Very Eligible |
| **Graphics Eligibility** | | | | |
| 11 | Accuracy of punctuation used in student worksheets on biological technology innovation topic | 25 | Uneligible |
| 12 | Suitability of illustrations/images in student worksheets with the topic discussed | 50 | Less Eligible |
| 13 | Presentation of illustrations/color pictures in student worksheets on biological technology innovation topic | 25 | Uneligible |
| 14 | The suitability of the cover of the student worksheet with biological technology innovation topic | 25 | Uneligible |
| **Total Score** | | **50** | **Less Eligible** |

Based on the table above, the eligibility score of the student worksheet from highest to lowest based on the eligibility of content, language, presentation, and graphics is a score of 100 (very eligible) on the indicator of the suitability of the questions with the demands of the TP, the accuracy of the concepts and definitions in the student worksheet, the accuracy of the examples and cases contained in the student worksheet, and the presentation of concepts coherently from simple to complex. Moreover, a score of 50 (less eligible) was assigned to the indicator of the suitability of illustrations/pictures in student worksheets in relation to the topic discussed. And the lowest score was 25 (uneligible), assigned to several indicators, including the suitability of the content with the learning outcomes (CP), the suitability of the material on the student worksheet with the learning objectives (TP), the depth and breadth of explanation to biological technology innovation topic that supports TP, the simplicity of the language used in the student worksheet, the spelling referring to PUEBI, the accuracy of the punctuation used in the student worksheet, the presentation of color illustrations/pictures in the student worksheet, and the suitability of the cover of the student worksheet with biological innovation and technology topic.

Three of the six indicators of the content eligibility of the student worksheet are in the very eligible category, whereas the other three are in the inappropriate category. This is not in accordance with the Depdiknas (2008), which states that the content feasibility component includes the suitability of the content with SK and KD, which in the merdeka curriculum was changed to CP and TP. Depdiknas (2008) asserts that the content of the student worksheet is based on the KD to be achieved. The topic can be presented in the form of supplementary information, such as an overview or scope of the substance to be studied.

The results of the linguistic eligibility of student worksheets (uneligible) show that the sentences used in student worksheets are not all effective sentences. The spelling indicator used in relation to PUEBI is also considered inappropriate because there are several words in the student worksheet that do not correspond to PUEBI. Errors in the use of spelling affect the quality of writing because a writing whose content is perfect cannot be said to be good writing if it contains many spelling errors (Karomah, 2022).

The eligibility of presentation is assessed based on the indicator of coherent presentation of concepts from simple to complex, which is worth 100 in the very eligible category. This was obtained through topic analysis and obtained the results of the overall topic presented coherently from simple to complex. This is the correct presentation according to Depdiknas (2008).

The highest score on the graphics eligibility is on the indicator of the suitability of illustrations/images in student worksheets with the topic discussed, with a value of 50 in the less eligible category. This is due to the fact that there are two illustrations/images in student worksheets that are not in accordance with the topic discussed. Furthermore, the indicator of the presentation of colored illustrations/images in student worksheets is also in the inappropriate category because student worksheets do not present colored illustrations/images. The indicator of the accuracy of punctuation used in student worksheet is worth 25 in the uneligible category. The assessment of the accuracy of punctuation used in the student worksheet is not eligible due to the presence of several incorrect punctuation writings.

**Completeness of Student Worksheet Components**

The results of the research indicate that the biology student worksheet on biological innovation and technology topic is 80 in the complete category. The completeness of the student worksheet components is evaluated based on the presence or absence of components or elements of student worksheets as teaching materials, as outlined by Daryanto and Dwi Cahyono (2014) and Prastowo (2021). These components include the title, learning outcomes, learning objectives, learning or work instructions, supporting information, tasks, activity steps, tools used, materials used, and assessment. The research data regarding the completeness of the student worksheet components can be seen in table 6.

Table 6. Completeness of student worksheet components assesment result

|  |  |  |  |
| --- | --- | --- | --- |
| **No** | **Indicator** | **Score** | **Classification** |
| 1 | Title | 100 | Complete |
| 2 | Learning outcomes | 100 | Complete |
| 3 | Learning objectives | 100 | Complete |
| 4 | Learning/work instructions | 100 | Complete |
| 5 | Supporting information | 100 | Complete |
| 6 | Tasks | 100 | Complete |
| 7 | Activity steps | 100 | Complete |
| 8 | Tools used | 0 | Incomplete |
| 9 | Material used | 0 | Incomplete |
| 10 | Assesment | 100 | Complete |
| **Score Total** | | **80** | **Complete** |

Based on the table above, the score for the completeness of the components of the student worksheet was 80. The student worksheet comprises eight of the ten components identified in the literature, namely title, learning outcomes, learning objectives, learning/work instructions, supporting information, tasks, activity steps, and assessment. The results obtained are consistent with Prastowo (2021), which identifies six main elements in student worksheets, namely title, learning instructions, basic competencies or subject matter, supporting information, tasks or work steps, and assessment. Two components that are not included in the student worksheet are the tools and materials used. This is not in accordance with Daryanto and Dwicahyono (2014), who state that student worksheets contain instructions for students regarding topics to be discussed, lesson objectives, subject matter and details, tools used, and instructions for the steps of learning activities.

**Student Worksheet Usefulness for Students**

The results indicate that the score of the usefulness of biology student worksheets for students on biological innovation and technology topic is 67,55 in the useful category. This score was obtained through an assessment using the student worksheets usefulness questionnaire, which was completed by students in class X-1, X-8, and X-10 MAN 1 Medan. The usefulness of student worksheets for students was assessed based on the benefits of student worksheets for students according to Prastowo (2021), Kristyowati (2018), Tanaka (2023), and Mudrikah (2021), namely activating students, making it easier for students to understand the given topic, as concise teaching materials and rich in tasks, facilitating interaction, training independence, providing information about learning concepts, making it easier to develop a concept, providing experiments, and creating more meaningful learning. The research data regarding the usefulness of student worksheets for students can be seen in table 7.

Table 7. Assessment of the student worksheets usefulness for students

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **No** | **Indicator** | **Class X-1** | **Class X-8** | **Class X-10** | **Total** | **Score** |
| 1 | Activating students | 68,92 | 65,38 | 88,64 | 222,94 | 74,31 |
| 2 | Making it easier for students to understand the given topic | 72,97 | 73,08 | 76,52 | 222,57 | 74,19 |
| 3 | As concise teaching materials and rich in tasks | 77,7 | 71,15 | 75,76 | 224,61 | 74,87 |
| 4 | Facilitating interaction | 65,54 | 61,54 | 75 | 202,08 | 67,36 |
| 5 | Training independence | 68,24 | 58,97 | 62,12 | 189,33 | 63,11 |
| 6 | Providing information about learning concepts | 62,84 | 55,77 | 59,09 | 177,7 | 59,23 |
| 7 | Making it easier to develop a concept | 67,57 | 60,26 | 55,3 | 183,13 | 61,04 |
| 8 | Providing experiments | 61,49 | 55,77 | 56,82 | 174,08 | 58,03 |
| 9 | Creating more meaningful learning | 66,22 | 71,15 | 90,15 | 227,52 | 75,84 |
| **Total** | | | | | | **607,99** |
| **Average Usefulness (Useful)** | | | | | | **67,55** |

The results indicated that the student worksheets utilized by students in learning activities were in the useful category with a value of 67,55. The questionnaire on the usefulness of student worksheets for students comprises nine indicators based on the benefits of student worksheets for students, as outlined by Prastowo (2021), Kristyowati (2018), Tanaka (2023), and Mudrikah (2021). Of the nine indicators assessed, three were found to be less useful. These were student worksheets providing information about learning concepts, student worksheets making it easier to develop a concept, and student worksheets providing experiments. The remaining six indicators, which are deemed useful, include student worksheets activate students, make it easier to comprehend the subject matter, student worksheets as teaching materials that are concise and rich in tasks, student worksheets facilitate interaction, student worksheets train independence, and student worksheets encourage more meaningful learning.

The indicator of student worksheets can activate students in developing concepts score is not in accordance with Tanaka (2023). Student worksheets are considered to be less effective in activating students in developing concepts. Students are only assisted several times in developing concepts when working on practice questions on student worksheet, as the questions presented have not been able to stimulate students to develop deeper concepts. The indicator of student worksheets providing information about learning concepts was also considered less useful. This is at odds with Tanaka (2023), who stated that student worksheets can facilitate the acquisition of knowledge about the concepts learned through systematic learning activities. The indicator of student worksheets providing experiments also in the less useful category. This is not in accordance with Mudrikah (2021), which states that student worksheets can help students delve deeper into the topic with the experiments. Although the student worksheet contains several of activities for to complete, it does not present experiments in a structured manner. Instead, it asks students to complete questions and project assignments.

**Student Worksheet Usefulness for Teachers**

Based on the results of the research conducted, the usefulness score of the biology student worksheets for teachers on biological innovation and technology topic is 78,55 in the usefulness category. The score was obtained through an assessment using a questionnaire on the usefulness of student worksheets filled out by a grade X biology teacher. The usefulness of student worksheets for teachers was assessed based on the benefits of student worksheets for teachers according to Prastowo (2021), Kristyowati (2018), Tanaka (2023), and Mudrikah (2021), namely, making it easier for teachers to teach topics, making it easier for teachers to give assignments to students, assist teachers in developing lesson plans, creating student-centered learning, and minimizing the role of teachers and activating students. The research data on the usefulness of student worksheets for teachers can be seen in Table 8.

Table 8. Assessment of the student worksheets usefulness for teachers

|  |  |  |  |
| --- | --- | --- | --- |
| **No** | **Indicator** | **Statement Regarding the Usefulness of Student Worksheets** | **Score** |
| 1 | Making it easier for teachers to teach topics | The process of teaching and delivering learning topics on biological technology innovation topic becomes easier when student worksheets are employed. | 75 |
| 2 | Implementation of learning activities on technological innovation topic becomes easier by using student worksheets. | 83,3 |
| 3 | Making it easier for teachers to give assignments to students | Giving assignments to students becomes easier because of student worksheets | 83,3 |
| 4 | The teacher is able to ascertain the level of student comprehension through the tasks included in the student worksheet | 75 |
| 5 | Assist teachers in developing lesson plans | The utilization of student worksheets can assist in the preparation of lesson plans on biological and technological innovation topic | 83,3 |
| 6 | Creating student-centered learning | The utilization of student worksheets enables teachers to establish a student-centered learning environment | 83,3 |
| 7 | Minimizing the role of teachers and activating students | The role of teacher in the learning process is less when student worksheets are utilized because student worksheets activate the role of students more | 66,7 |
| **Total** | | | **549,9** |
| **Average Usefulness (Useful)** | | | **78,55** |

The results of the assessment of the usefulness of student worksheets for teachers were obtained through the results of a questionnaire on the usefulness of student worksheets for teachers filled in by three biology teachers. Based on the tabel above, it can be seen that the results indicated that the student worksheets utilized in the instruction of biology on the subject of biological innovation and technology were classified within the category of useful, with a value of 78,55. As stated by Prastowo (2021), Kristyowati (2018), Tanaka (2023), and Mudrikah (2021), the benefits of student worksheets for teachers include making it easier for teachers to teach topics, making it easier for teachers to assign assignments to students, assisting teachers in developing lesson plans, creating student-centered learning environment, and minimizing the role of the teacher and activating students.

**Student Learning Activities by Using Student Worksheets**

Student learning activities were assessed using an observation sheet completed by the observer. The analysis of student learning activities was conducted on three occasions during each meeting, in three different classes. The results of the research indicate that the score of student learning activities with the help of student worksheets is 5,84 in the inactive category. The assessment of these activities is based on the indicators of the Understanding by Design (UbD) approach, namely explaining, interpreting, applying, empathy, perspective, and recognition or self-reflection. The data on student learning activities is presented in table 9.

Table 9. Assessment of student learning activities with student worksheets

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No** | **Indicator** | **Meeting** | | | **Score per Indicator** |
| **1** | **2** | **3** |
| 1 | Explanation Activity | 12,33 | 7,67 | 20,22 | 13,41 |
| 2 | Interpretation Activity | 2,89 | 2,02 | 1,92 | 2,28 |
| 3 | Application Activity | 0,9 | 0,85 | 0,63 | 0,79 |
| 4 | Perspective Activity | 6,015 | 3,49 | 1,01 | 3,51 |
| 5 | Empathy | 3,88 | 3,65 | 0,51 | 2,68 |
| 6 | Self-Recognition or Reflection | 11,47 | 15,39 | 10,33 | 12,40 |
| **Total Score** | | | | | **35,06** |
| **Average Score** | | | | | **5,84** |

The results of the assessment of student learning activities in classes X-1, X-8, and X-10 were obtained through the use of a predetermined observation sheet by observers who conducted the assessments. The indicators of student learning activity observation consist of six indicators that are in accordance with the Understanding by Design (UbD) approach developed by Wiggins and Tighe. The aforementioned indicators include the activities of explaining, interpreting, applying, perspective, empathy, and recognition or self-reflection. The observed score for student learning activities was 5,84 in the inactive category.

The explanation indicator is comprised of five assessment aspects: students describe an idea using their own language, students identify the relationship between a phenomenon and other phenomena, students provide illustrations or examples that elucidate a phenomenon, students demonstrate work results that contain facts, and students explain the reasons for the occurrence of a phenomenon. The interpretation indicator is assessed based on three activities: students telling meaningful stories related to the topic being discussed, students deciphering simple notes from complex notes, and students interpreting an idea, feeling, or work from one medium to another. In the application activity, students are expected to demonstrate the ability to apply their knowledge in real-world contexts. The perspective indicator is divided into two activities, namely students explain the opposite side of a situation related to the learning topic and students criticize a phenomenon or other opinions. The empathy indicator also is divided into two activities, namely students accepting thoughts that are different from their own and students accepting criticism from others that is different from their opinions. The indicator of self-recognition or reflection divided into two activities: students recognizing aspects of themselves that they do not comprehend a topic and students asking about topics they do not comprehend to develop their understanding.

The student learning activities are considered to be inactive, as the student worksheets do not accommodate student learning based on the Understanding by Design (UbD) approach. This is not in accordance with BSKAP (2022), which states that "understanding" is an ability that is built through learning processes and experiences that provide opportunities for students to be able to explain, interpret, and apply information, use various perspectives, and empathize with a phenomenon. BSKAP also indicates that CP can be designed with a substantial degree of reference to constructivist learning theory and the Understanding by Design (UbD) approach. Consequently, it can be inferred that the results of student learning activities do not align with the requirements of the Merdeka curriculum, as outlined in BSKAP and Kemdikbud.

**CONCLUSION**

The student worksheets analyzed obtained a score of 50 (less eligible) in the eligibility aspect, a score of 80 (complete) in the component completeness aspect, a score of 67,55 (useful) in the aspect of usefulness for students, and a score of 78,55 (useful) in the aspect of usefulness for teachers. Student learning activities with the help of student worksheets obtained a score of 5,84 in the inactive category. Based on these result, it is recommended that the selection of teaching materials, including student worksheets, be carried out carefully in accordance with the applicable curriculum and by taking into consideration the needs of the students. This is necessary in order to ensure that the learning objectives can be achieved through an effective learning process with the help of student worksheets.

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