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Development of Innovative Student Worksheet Using Google Sites for Reproductive System Material

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Abstract: This study aims to determine 1) the development of student worksheet based on problem-based learning (PBL) on reproductive system material using Google sites and 2) the feasibility of student worksheet based on problem-based learning (PBL) on reproductive system material for class XI. This research was a research and development using the 4D model, consisted of define, design, develope, and disseminate. Student worksheet was developed using Google Sites. The validity test was carried out with expert judgment by material and media experts. External validity was conducted by biology teachers as practitioners and high school class XI students. The results showed that the results of the development of student worksheet based on Google Sites are in accordance with the 4D development stage and PBL-based student worksheet using Google Sites on reproductive system material are suitable for use based on the material and learning media aspects. Based on the assessment of material experts, learning media experts, and biology teachers as practitioners, this student worksheet is in the "very good" category, while the assessment by students as trial participants is in the "good" category. This student worksheet contains issues related to reproductive health. The media used is based on website mode, so all smartphone users can use it. It can be concluded that PBL-based student worksheet using Google Sites is feasible for use in the implementation of reproductive system biology learning materials.

Keywords: Google Site; Problem Based Learning; Reproductive System; Student Worksheet

Introduction

Education is an attempt to change the attitudes and behaviors of a person or group for the better through teaching efforts. Education is a very important aspect of an individual's survival. Along with the times, education has also changed in the 21st century. Education in the 21st century aims to prepare students to face future challenges by developing 21st century skills and integrating information and communication technology into the learning process (Frydenberg & Andone, 2011). 21st century skills include communication, collaboration, creativity, and critical thinking (Arifin, 2017).

21st century learning demands student-centered learning (Ministry of Education and Culture's Regulation, 2014). However, current learning tends to be teacher-centered, which causes students to become passive, lazy to study, feel bored when learning takes place, and lack understanding of learning material (Asrori & Suparman, 2019). Another problem is the availability of teaching materials in schools, which are still conventional (Asma et al., 2020), and their use is not yet effective and efficient (Syafitri & Tressyalina, 2020). That is the challenge in learning biology, namely, how to make students remain enthusiastic about participating in learning. Therefore, it is necessary to have interactive teaching materials, which are really needed by students and teachers (Zahara et. al., 2021)

One of the interactive and innovative teaching materials is the student worksheet (Costadena & Suniasih, 2022). Electronic Student Worksheets are a

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sequential activity to carry out investigations and problem solving by students. Student worksheet in the form of a work guide is used to make it easier for students to understand learning material as outlined in electronic form and applied using desktops, notebooks, smartphones, computers, or mobile phones (Putriyana et al., 2020). Student worksheet is printed teaching material that contains learning material, exercises, as well as instructions or steps for completing a task and refers to basic competencies so that learning objectives can be achieved (Fahrurozi et al., 2022). The use of student worksheet in learning has an impact on fun student learning activities when students' interest in learning decreases (Syafitri & Tressyalina, 2020), learning becomes more interactive, and student understanding is strengthened (Koderi et al., 2020).

Changes that occur in learning and demands for innovation are important things to do (Amin, 2017). Currently, various applications are available and can be used by teachers to develop learning media. One learning innovation that is widely used by teachers is the use of websites in learning through web-based learning (PBW). In accordance with the opinion of Batubara (2018), which states that websites can help students learn and make it easier for teachers to facilitate learning, Various applications that teachers can use to create websites are Google Sites. The Google Sites platform is still the same service as Google Workspace for Education, which has several advantages such as free applications, easy use, and the ability to be managed together or collaborate in managing it (Sulasmianti, 2021). Google sites, which are used as learning media, can make it easier for students to remember teaching materials and have a high element of interactivity (Adzkiya & Suryaman, 2021).

One of the materials for learning biology is the material on the reproductive system. Reproductive system material in biology is given to students in grade 11 science. There are various learning resources that can be used to study this material, such as learning modules, learning videos, and practice questions. Using the right media in learning biology is one of the solutions to the problem of making learning interesting so that it can increase students' attention to the topics being studied, interest, and motivation so that they can concentrate more (Sirakaya & Cakmak, 2018).

In addition to teaching materials that are used interactively and innovatively, appropriate learning models are needed for students. One learning model that can be used to support 21st century skills is the Problem Based Learning model. The problem-based learning (PBL) model is a model whose learning process is oriented towards various real-life problems so that it can find various solutions. The PBL model is focused on the problems presented by the teacher, and students can solve these problems with all the knowledge and skills obtained from various sources. This PBL model aims to build and develop learning that fulfills three learning domains, namely cognitive, psychomotor, and affective (Nurtanto & Sofyan, 2015). Apart from that, the PBL model can be applied because it can improve student learning activities and student biology learning outcomes (Dewi et al., 2019).

The objectives of this research and development study are: 1) the development of problem-based learning (PBL) student worksheet on reproductive system material using Google sites; and 2) the feasibility test of student worksheet on reproduction system material for class XI.

Method

This research and development project aims to develop a problem-based learning (PBL)-based student worksheet. The development model used is the 4D development model. This development has four stages: define, design, develop, and disseminate. The student worksheet product was developed to support class XI high school students in increasing health literacy.

Figure 1. Research Framework

At the definition stage, the selection of the material to be used is carried out. The material in this study used material on the human reproductive system listed in the biology curriculum used by class XI high school students. The learning objectives for this material refer to the Basic Competencies contained in Ministry of Education and Culture's Regulation Number 37 of 2018. The basic abilities that must be achieved by students in the reproductive system material are listed in 3.12, Analyzing the relationship between the structure of the reproductive organs and their functions in the human reproductive system, and 4.12, Presenting the results of an analysis of the impact of promiscuity, diseases, and abnormalities in the structure and function of organs that cause disruption to the human reproductive system and reproductive system technology (Ministry of Education and Culture's Regulation, 2018).

Furthermore, at the design stage, media selection is carried out. The media used in this research and development use Google sites. The reason for choosing this medium is that, in website mode, student worksheet can be used by Android and iOS users. Furthermore, in the development stage, through the validation stage. Internal validation is carried out by expert judgement from media and material experts. The selected learning

media experts are lecturers who have qualifications in learning and multimedia programs. Material experts are lecturers with expert qualifications in the field of reproductive system material. In the external validation stage, the student worksheet was assessed by a biology teacher or practitioner and 28 high school students in class XI. The assessment is in the form of the responses of class XI high school students to the PBL-based student worksheet.

Collecting data using an assessment questionnaire includes a questionnaire of material experts, media experts, and the assessment of teachers and students. The material assessment questionnaire consists of four aspects: the feasibility and accuracy of the material, the presentation of the material, the relevance of facts to concepts, and the language aspect. The media assessment questionnaire was carried out, covering two aspects, namely the software engineering aspect and the visual aspect. The teacher/practitioner assessment questionnaire includes four aspects: material aspects, media aspects, learning aspects, and language aspects. The student assessment questionnaire consists of learning aspects, language aspects, and technical aspects. All assessment questionnaires were developed using a Likert scale of 1–4 (very feasible–very unfeasible).

Qualitative data in the form of comments and suggestions is used to revise the product. While validation questionnaire data from expert lecturers, teachers, and students was analyzed using Formula 1.

$$M = \frac{\sum fx}{N} \quad (1)$$

Note:
M = Average per aspect
$\sum fx$ = Sum of scores per aspect
N = Number of components

After getting the average data per aspect, convert the average score to a value of 100 by (Formula 2).

$$\text{Value per aspect} = \frac{\text{Average score}}{\text{Max score}} \text{ x } 100 \quad (2)$$

Furthermore, the interpretation of each aspect is categorized according to the following categories:

Table 1. Interpretation of aspects

Score	Category
81 – 100	Very Good
61 – 80	Good
41 – 60	Enough
21 – 40	Less
≤ 20	Not Good

Result and Discussion

The products produced in this research and development are problem-based learning-based biology teaching materials assisted by Google sites in the form of Electronic Student Worksheets on human reproductive system material, which can be accessed by class XI students. This student worksheet can be operated on various operating systems, both Android and iOS, because it is in the form of a website.

This research and development uses a 4D model consisting of define, design, develop, and disseminate stages. At the definition stage, an initial analysis was carried out regarding the needs of one of the schools in Magelang. It was found that learning biology still uses conventional learning methods, namely lecture and discussion methods. Furthermore, the learning media used by teachers still include printed books and PowerPoint. While the use of information technology devices such as smartphones as facilities during the learning process is still not optimal, this can be seen in learning that has not been integrated with information technology. Therefore, there is potential for the development of student worksheets that students can access via smartphones.

After definition, the next stage is design. This design stage is carried out for the selection of media and the initial design of the student worksheet. The selection of media is adjusted by identifying student worksheet that is relevant to the characteristics of the material and the convenience factor in providing the necessary equipment to facilitate the achievement of learning objectives. Currently, technology continues to develop, and smartphone operating systems have started to be sophisticated. There are Android and iOS operating systems. Based on this, the student worksheet designed and developed in this study is in the form of an student worksheet using a website assisted by the Google site. By using Google sites, it is hoped that the student worksheet can be used by Android and iOS users.

The preparation of the initial draft resulted in a student worksheet draft that contained titles, competencies to be achieved, reproductive system learning materials that were appropriate to problem-based learning (PBL), assignments, and supporting information. Each activity in the PBL-based student worksheet contains learning objectives that will be used as a guide for students about what will be achieved after they work on the student worksheet.

The problems found in the PBL-based student worksheet are material for discussion based on problems in the reproductive system that must be resolved through group and independent discussion activities. The PBL-based student worksheet consists of

three activities. These activies are activity 1, containing the topic Structure and Function of the Male and Female Reproductive Organs, raised the issue of the importance of male circumcision and the effects of shaving pubic hair. This problem discusses the structure and function of organs in the reproductive system related to reproductive health. Then activity 2, contains the topics Menstrual Cycle, Fertilization, Gestation, and Childbirth, raising issues about the menstrual cycle that lasts a long time and myths related to molar pregnancy. In this activity, students are expected to be able to find solutions related to how to overcome menstrual cycles that last a long time and find the causes of molar pregnancy. Then activity 3, which contains the topics Disorders and Abnormalities and Reproductive System Technology, raises issues related to the Human Immunodeficiency Virus (HIV/AIDS) and menstrual cup use. In this activity, students are expected to be able to analyze reproductive system disorders, namely HIV/AIDS and the use of menstrual cups, as examples of the application of technology to the reproductive system.

The PBL-based student worksheet is equipped with learning videos that can help students better understand reproductive system material. In addition, in each activity, it is equipped with practice questions based on the activity topic. The next stage is development.

At the product development stage, PBL-based student worksheet are validated. This validation is carried out to assess the feasibility of the developed student worksheet product. The assessment of the material includes four aspects: the feasibility and accuracy of the material, the presentation of the material, the relevance of facts to concepts, and the language aspect. The results can be seen in Table 2.

Table 2. Material Expert Validation Results

Aspects of Assessment	Score	Category
Aspects of material feasibility and material accuracy	100	Very Good
Aspects of material presentation	100	Very Good
Aspects of the relevance of facts to the concept	100	Very Good
Language aspect	75	Good
Average	93.75	Very Good

The results of the assessment of the four aspects used showed a final average score of 93.75 with a very good category. All aspects get a perfect score of 100, except for the language aspect, which gets a score of 75. The feasibility aspect of the material content meets very good criteria with a score of 100%. This aspect is very important because good material can improve the quality of learning. Material content can be said to be good and of good quality if it has appropriate, complete, coherent material content, supports learning objectives, has clear material content, and uses image or video media. Overall, it can be concluded that the PBL-based student worksheet biology teaching materials are assisted by the Google site has been feasible to use for learning in terms of material.

Meanwhile, the assessment of the media includes two aspects, namely aspects of software engineering and visual communication aspects. The results of the assessment can be seen in Table 3.

Table 3. Media Expert Validation Results

Aspects of Assessment	Score	Category
Aspects of software engineering	100	Very Good
Aspects of visual communication	97.5	Very Good
Average	98.75	Very Good

The results of the assessment of the two aspects used show an average score of 98.75 in a very good category. The software engineering aspect gets a score of 100, while the visual communication aspect gets a score of 97.5. On the media aspect, the validator did not provide specific suggestions or input. Overall, it can be concluded that the PBL-based student worksheet assisted by the Google site is appropriate for use for learning in terms of the media. This is in line with research by Ariani et al. (2023) that student worksheet, which is appropriate in terms of media, can help students easily access and understand learning material.

Assessment of the PBL-based student worksheet assisted by the Google site by practitioners (Biology teachers), which was carried out, covered four aspects, namely material aspects, media aspects, learning aspects, and language aspects. The results can be seen in Table 4,

Table 4. Biology Teacher Validation Results

Aspects of Assessment	Score	Category
Material aspect	100	Very Good
Media aspect	87.5	Very Good
Aspects of learning	75.0	Good
Language aspect	85.0	Very Good
Average	86.88	Very Good

The results of the assessment of the four aspects used showed a final average score of 86.88, with a very good category. The highest score is obtained on the material aspect, while the aspect that gets the lowest score is the learning aspect. This practitioner validator also provides input for reviewing competency achievements that will be used so that they are used

effectively during learning and in accordance with competency achievement indicators. The suitability of the material with the learning objectives is important to help students acquire basic concepts and initial knowledge so that they can understand more complex concepts *(Daniel, 2020)*. Overall, it can be concluded that the PBL-based student worksheet is feasible to use for learning.

Prior to use, the PBL-based student worksheet assisted by the Google site was tested on a limited basis with class XI MIPA students as users. Limited trials were carried out to obtain student responses or assessments related to the legibility of the student worksheet. The results of student responses or assessments can be seen in table 5.

Table 5. Student Response Results

Aspects of Assessment	Score	Category
Aspects of learning	77.8	Good
Language aspect	76.8	Good
Technical aspects	79.5	Good
Average	78.0	Good

The assessment of the three aspects used shows a final average score of 78 in the good category. Overall, it can be concluded that students, as users of teaching materials, have a positive response to PBL-based student worksheet assisted by the Google site. The following is a picture of the student worksheet that was developed.

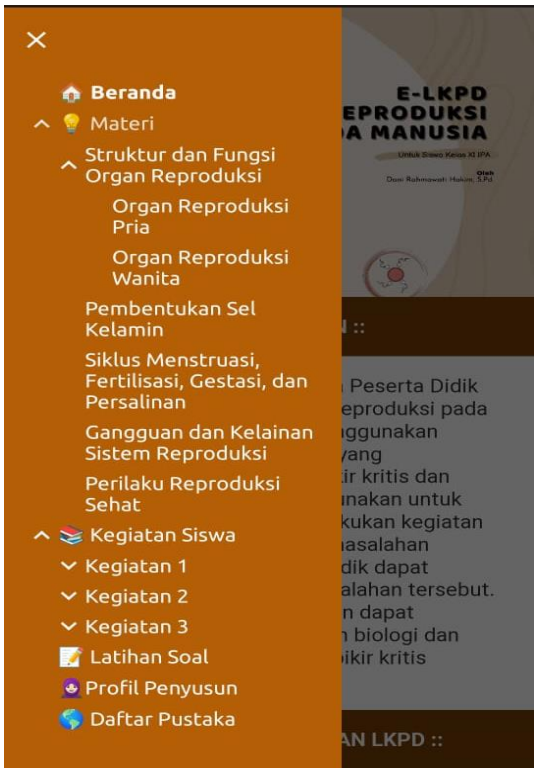

Figure 2. The Structure of the Student Worksheet

The PBL-based electronic student worksheet developed in this study can be used by teachers as learning media for reproductive system material. Student worksheet can be used in website mode so that it can be accessed by Android and iOS users. The developed student worksheet is one of the learning media that can be used by students in learning biology with material on the reproductive system. By using relevant and interesting media, students can be encouraged to participate actively in the learning process (Umam, 2018).

Student worksheet products have passed the stages of internal validation and external validation. In internal validation, Student worksheet was assessed by material experts and learning media experts, then by biology teachers as practitioners. Furthermore, the student worksheet was revised according to input from material experts, media experts, and practitioners to then be tested on class XI high school students. In the external validation stage, the revised student worksheet is given to students as trial participants. Student responses to the student worksheet were very positive and could be developed for other materials. This is because innovative electronic student worksheet can reduce boredom because it becomes an interesting tool when students' interest in learning decreases (Syafitri & Tressyalina, 2020). Besides that, the advantage of student worksheet is its flexible use because it is not limited by space and time (Masing & Aminatun, 2022). Student worksheet can be used as an innovative approach to teaching and learning that can help meet the demands of the 21st century (Suryaningsih & Nurlita, 2021).

The use of PBL-based student worksheet is based on real-life problems, and from the problems presented, students are stimulated to study problems based on previous knowledge and experience, so that from this experience, new knowledge and experience will be formed (Sofyan et al., 2017). PBL models vary widely throughout the world, but the core of PBL learning is student-centered, group work, and real-life problem solving (Zhou, 2021). Apart from that, the PBL model can also make students think critically because they will be guided to focus first on the problem and trained to defend arguments and provide several reasons (Noprianda et al., 2019). Furthermore, research by Fitriyah & Ghofur (2021) explains that the use of Android-based student worksheet with a PBL model makes it easier for students to learn independently so that the knowledge gained can be absorbed well (Risdiany et al., 2022).

Learning using a website with Google Site is expected to have a positive impact on students because the learning process is not limited by space anytime and anywhere (Warsita, 2018). Apart from that, the

appearance of the Google site, which contains images and videos that are attractive, can build students' interest in learning by using the student worksheets (Damayanti & Ratnasari, 2021).

Based on the results of assessments and improvements made based on suggestions from material experts, media experts, and practitioners (biology teachers), the PBL-based student worksheet on the reproductive system material developed can be declared valid or suitable for use in learning. This is in line with Minarni's research (2023), which shows that student worksheet can be declared effective in improving learning outcomes when viewed from the perspective of media experts, material experts, and practitioners. This is in line with the opinion of Verstegen et al. (2016), which states that the use of e-learning can support the implementation of learning using the PBL model because it can increase students' ability to learn. Apart from helping facilitate the implementation of learning activities, using student worksheet can help improve students' understanding of the material provided so that the learning process is more fun, interactive, and stimulates students to learn (Puspita & Dewi, 2021). Therefore, student worksheets with the help of PBL-based Google sites can be used in learning because they are feasible based on the assessments that have been carried out. This is also in line with research by Nurjanah & Trimulyono (2022) showing that PBL-based student worksheet is effectively used in learning.

Conclusion

Based on the data obtained in the development of the student worksheet, it can be concluded that the development of PBL-based student worksheet on reproductive system material is in accordance with the 4D development model through four stages, namely define, design, develop, and disseminate. PBL-based student worksheet is suitable for use in terms of substance, material, and learning media. Based on research and the assessments of material experts and learning media experts, this student worksheet is belong to "very good" category; while based on the teacher's or practitioner's assessment, it is considered as "very good". Lastly, the assessment by students as trial participants indicated that this student worksheet is in the "good" category.

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The authors declare that there is no conflict of interest regarding the publication of this paper.

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