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DISTANCE LEARNING MATHEMATICS USING PQ4R LEARNING STRATEGIES (*PREVIEW, QUESTION, READ, REFLECT, RECITE AND REVIEW*)

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Abstrak

Pandemi Covid-19 yang melanda Indonesia memberikan tantangan bagi para pendidik untuk menemukan alternatif pembelajaran jarak jauh yang efektif dan efisien. Oleh karena itu penelitian ini bertujuan untuk mengembangkan perangkat pembelajaran matematika jarak jauh menggunakan strategi pembelajaran PQ4R (*Preview, Question, Read, Reflect, Recite and Review*) yang valid, praktis dan efektif. Jenis penelitian ini adalah penelitian pengembangan yang menggunakan model pengembangan Plomp. Subjek penelitian ini adalah guru bidang studi matematika dan siswa kelas 7. Perangkat pembelajaran yang dikembangkan terdiri dari RPP dan LKPD pada materi himpunan. Fase pengembangan terdiri dari fase investigasi awal, fase desain, fase realisasi atau konstruksi serta fase tes, evaluasi dan revisi. Metode pengumpulan data yang digunakan adalah wawancara, tes, observasi dan angket. Hasil penelitian menunjukkan bahwa pada fase preliminary research guru membutuhkan alternatif perangkat pembelajaran jarak jauh yang dapat membantu penyampaian materi dan meningkatkan pemahaman peserta didik sehingga hasil belajarnya dapat lebih baik. Pada fase realisasi atau konstruksi serta fase tes, evaluasi dan revisi telah berhasil dikembangkan perangkat pembelajaran matematika jarak jauh menggunakan strategi pembelajaran PQ4R yang termasuk dalam kategori valid dan praktis. Hal ini tampak dari rata-rata kevalidan RPP dan LKPD berturut-turut sebesar 3,78 dan 3,87. Sedangkan rata-rata kepraktisannya berturut-turut sebesar 3,93 dan 3,92. Perangkat yang dikembangkan juga terbukti efektif diterapkan di sekolah dengan 100% terlaksananya sintaks pembelajaran, respon peserta didik yang sangat positif dan hasil belajar peserta didik termasuk dalam kategori sangat baik dengan persentase ketuntasan sebesar 90,63%.

Kata kunci: Himpunan; pembelajaran matematika jarak jauh; strategi pembelajaran PQ4R

Abstract

The Covid-19 pandemic that has hit Indonesia poses a challenge for educators to find alternatives to distance learning that are effective and efficient. Therefore, this study aims to develop a distance learning mathematics tool using PQ4R (Preview, Question, Read, Reflect, Recite and Review) learning strategies that are valid, practical and effective. This type of research is development research that uses the Plomp development model. The subjects of this study were teachers of mathematics studies and 7th grade students. The learning tools developed consisted of lesson plans and LKPD on the set material. The development phase consists of an initial investigation phase, a design phase, a realization or construction phase and a test, evaluation and revision phase. Data collection methods used are interviews,

tests, observations and questionnaires. The results showed that in the preliminary research phase, teachers needed alternative distance learning devices that could help deliver material and improve students' understanding so that their learning outcomes could be better. In the realization or construction phase as well as the test, evaluation and revision phase, distance mathematics learning tools have been successfully developed using the PQ4R learning strategy which is included in the valid and practical categories. This can be seen from the average validity of the RPP and LKPD of 3.78 and 3.87, respectively. Meanwhile, the average practicality is 3.93 and 3.92, respectively. The tools developed were also proven to be effectively implemented in schools with 100% implementation of the learning syntax, very positive student responses and student learning outcomes included in the very good category with a percentage of completeness of 90.63%.
Keywords: Distance learning; PQ4R learning strategies; Set

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INTRODUCTION

The global Covid-19 pandemic that has hit since March 2020 has made a total change in lifestyle. Because this virus can spread quickly through the air from the coughs and sneezes of the sufferer and all activities through hand contact (Susilo, Rumende, Pitoyo, Santoso, & Yulianti, 2020). How to respond to such a situation was explained by the Prophet sallallaahu 'Alaihi Wassallam by reducing the mobilization of residents both inside and outside the affected area (Kurniawan, 2020). This is of course in accordance with the policy issued by the Ministry of Education and Culture of the Republic of Indonesia to carry out Distance Learning online during this pandemic.

Distance learning is carried out through various applications and *web addresses* that can be accessed through devices and internet network availability, such as: *Zoom, Google Meet, Google Classroom, WhatsApp, YouTube, Tuweb* (Anugrahana, 2020). To launch Distance Learning activities during the pandemic, the government and various organizations and agencies extended assistance in the form of affirmative BOS, giving credit, free internet quota to cellphones for students and teachers so that they can continue their education.

However, after running for a long time, the Distance Learning that is implemented seems to still need the right formula. According to research conducted by Henra & Masliah (2021) students experience anxiety feel afraid, and confused when given questions or questions during distance learning because the learning materials provided cannot be understood properly due to network technical constraints. In another study conducted by Asmuni (2020) and Mustakim (2020) Limited support facilities and unstable internet network access are also obstacles in the implementation of distance learning.

Independence and learning initiative that tend to be low due to study habits that are not the same as during face-to-face learning indicate that students are not quite ready to participate in distance learning (Hidayat, Rohaya, Nadine, & Ramadhan, 2020). This causes students to be less active and difficult to focus in participating in distance learning so that their understanding of concepts and problem solving abilities is not good, this can be seen from the results of research by Mahfud, Mardiyana, & Fitriana (2021) which shows that students still have difficulty in using, utilizing and choose a particular procedure, operation or algorithm for problem solving. Therefore, the teacher must find the right distance learning strategy so that students' understanding of the concepts of the material obtained can be evenly distributed in situations where not all sub-materials can be conveyed to students.

Some of the obstacles above have attracted the attention of researchers to develop mathematics learning tools that use the PQ4R strategy (*Preview*, *Question*, *Read*, *Reflect*, *Recite* and *Review*) in distance learning in the midst of a pandemic. The reason for choosing the PQ4R learning strategy is because this strategy can improve students' understanding of mathematical concepts (Ulfa, 2019). In addition, in a study conducted by Gardenia, Herman, & Dahlan (2019) shows that the application of the PQ4R strategy can improve students' mathematical communication skills compared to the application of conventional learning. The ability to understand concepts and good mathematical communication will certainly be able to improve students' mathematics learning outcomes. This is evident from research that has been conducted by (Maulyda,

Fauzi, Affandi, Haryati, & Istiningsih, 2020) which shows that the PQ4R strategy can improve student learning outcomes on the topic of Algebra. In addition to learning the topic of Algebra, Geometry learning outcomes of students who take lessons using the PQ4R strategy are also included in the good category (Farapatana, Anwar, & Abdillah, 2019; Yuliana & Fajriah, 2013).

The PQ4R learning strategy itself is a strategy used to help students remember the material they have read and can help the learning process in the classroom which is carried out by reading books (Trianto, 2007). Students can start by reading the title, topic, initial sentence or final sentence of the reading that will help students understand the concept they are reading . Furthermore, at the *Question stage* , students conduct questions and answers with the teacher or friends using the help of 5W1H (*who, what, where, why, when & how)* . Students begin to read the lesson material given actively by reacting to what is read at this stage. *Read* . This can be done by making short notes containing ideas from the reading or by looking for answers to the assignments given by the teacher. After reading the material, at the *Reflect stage* , students are trained to develop visual perceptions by imagining examples of problems contained in the questions and linking with the knowledge they already have, linking the topic in the reading with the main concept being studied. Furthermore, students are asked to recall the information that has been learned by stating important points aloud or by answering questions at the *Recite stage* . At the last stage, namely *Review* , the teacher will ask the player The students review the things they get in response to the questions/readings given by the teacher (Al-Qawabeh & Aljazi, 2018).

Based on the explanation above, this study aims to develop mathematics learning tools using the PQ4R learning strategy (*Preview, Question, Read, Reflect, Recite and Review*) in distance learning that is valid, practical and effective.

METHOD

This research is a development research using the Plomp development model. This research was conducted in class VII D of Public Junior High School 1 Duduksampeyan Gresik . The research subjects were teachers of mathematics

studies and 32 students of class VII D. This research procedure followed the phases of the Plomp development model which were limited to 4 phases, namely: 1) The *preliminary research phase* which consisted of preliminary analysis, curriculum analysis , student analysis, and material analysis; 2) The design phase *(design)* ; 3) Realization or construction phase *;* and 4) Test, Evaluation and Revision Phase *(test, evaluation and revision).* The implementation phase was not carried out because the research was still limited to one school.

Data collection methods used in this study were interviews, tests, questionnaires and observations. The instruments used are interview guides, learning outcomes test sheets, learning device validation questionnaire sheets, learning device practicality questionnaire sheets, student response questionnaire sheets and learning implementation observation sheets.

Data analysis of the validity and practicality of the learning tools developed was carried out by calculating the average total validity and practicality of the lesson plan and student worksheet with the following formula

$$VR = \frac{\sum_{i=1}^{n} RA_i}{n} \text{ ann } KR = \frac{\sum_{j=1}^{n} RK_j}{n}$$

where *VR* is the average total validity , *RAi* is the average value for the i-th aspect , KR *is the* average total practicality , *RKj* is r the average of the *j* -th indicator and *n* is the number of aspects . The average value of the total validity of the lesson plan and student worksheet is referred to the interval determining the level of validity in Table 1 below:

Table 1. Criteria For The Validity of Lesson Plan and Student Worksheet

Score Interval	Category Validity
$VR = 4$	Very Valid
$3 \leq VR < 4$	Valid
$2 \leq VR < 3$	Less Valid
$1 \leq VR < 2$	Invalid

Meanwhile, the average value of the total practicality of lesson plan and student worksheet is referred to the interval for determining the level of practicality in Table 2 below:

Table 2. Practical Criteria for Lesson Plan and Student Worksheet

Score Interval	Category Validity
$KR = 4$	Can be used without revision
$3 \leq KR < 4$	Usable with minor revisions
$2 \leq KR < 3$	Can be used with multiple revisions
$1 \leq KR < 2$	Can not be used

Learning tools are said to be practical if the validators state that these learning tools can be used in the field with "little revision" or "no revision".

Learning tools are said to be effective if the student's response is at least in the positive category, the student's learning outcomes are at least in the good category and the implementation of the learning steps is at least in the good category. The data obtained based on the student response questionnaires were analyzed by percentage and interpreted using the criteria in Table 3 below:

Table 3. Student response criteria

Percentage of Response Value	**Category**
75 ≤ NR 100	Very Positive
50 ≤ NR <75	Positive
25 ≤ NR <50	Less Positive
0 ≤ NR <25	Not Positive

While the data analysis of student learning outcomes was analyzed by determining the percentage of students who got a minimum test score of 75 then categorizing based on the assessment criteria in Table 4 below :

Table 4 . Criteria for Student Learning Outcomes

Percentage	Classification
$P_n > 80$	Very good
$60 < P_n \leq 80$	Well
$40 < P_n \leq 60$	Enough
$20 < P_n \leq 40$	Not good
$P_n \leq 20$	Very less

Observation data on the implementation of learning steps were analyzed by determining the percentage of learning activities that could be carried out in

accordance with the lesson plans and categorized based on the provisions in Table 5 below. (Sudjana, 2002):

Table 5 . Criteria for The Implementation of The Learning Steps

Percentage of Execution	Category
K ≥ 90	Very good
80 ≤ K < 90	Well
70 ≤ K < 80	Enough
60 ≤ K < 70	Not enough
K < 60	Very less

RESULT AND DISCUSSION

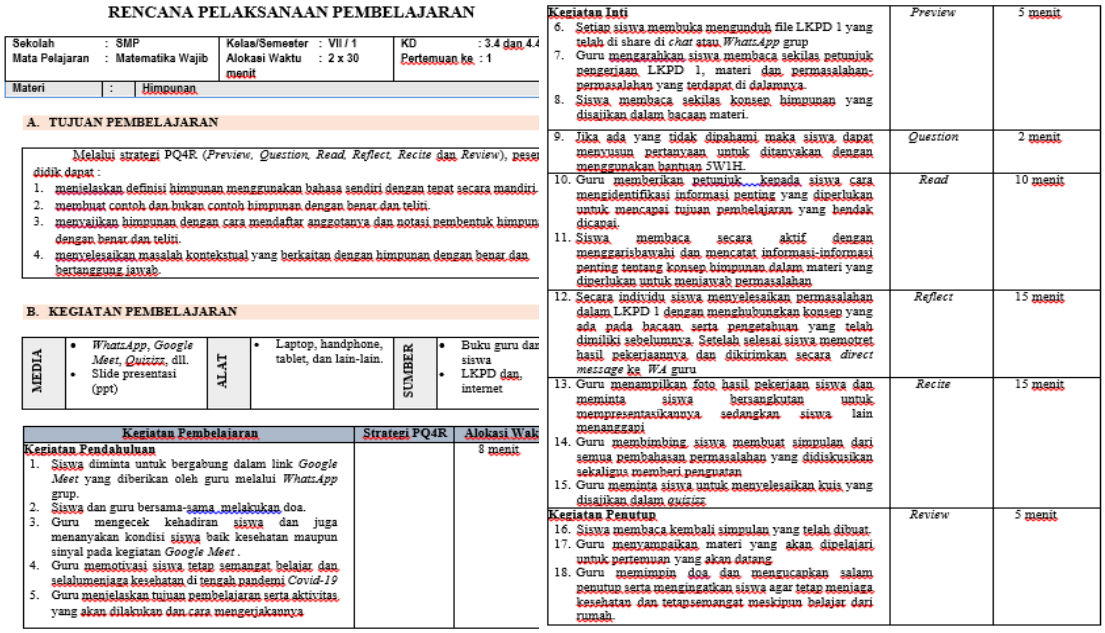
Description and data analysis of research results is presented following the phases in the Plomp development model which is limited to 4 phases, namely: 1) *Preliminary research phase* ; 2) *Design* phase ; 3) *Realization or construction* phase ; and 4) The *test, evaluation and revision* phase . The following describes the results of the four phases in detail.

***Preliminary research* phase** aims to identify the needs needed to develop learning tools including problems experienced in class, previous learning processes, student characteristics and the scope of the material to be taught. Based on interviews with teachers in the field of mathematics studies, data was obtained that during the pandemic the school used an emergency curriculum and the distance learning process was carried out using a direct learning model with the WhatsApp (WA) platform. WA was chosen because the students are familiar with using the application and its use does not require a large quota. The practicality of using the *WhatsApp* platform in distance learning is also in accordance with the results of research conducted by Mustakim (2020). Students like this media because it is considered easy and practical to use and does not take up too many quota pulses. Wibawa & Payadnya also stated the same thing (2021)which stated that the use of *WhatsApp was* effective in learning mathematics. However, the use of WA is considered still not effective in delivering subject matter. Many students still feel confused about understanding the material if they learn only by reading the material distributed by the teacher through WA. This condition is in

accordance with the results of research from Suharti, Nur & Khusnah (2021)which states that the use of WhatsApp in learning has not been effective because there is less interaction between learners and educators. Therefore, face-to-face meetings via *online* need to be carried out. The researcher chose the use of *Google Meet* in learning mathematics because it was in accordance with the results of Aisyah & Sari 's research (2021)which stated that *the Google Meet platform was* effective in improving the mathematics learning outcomes of junior high school students. In addition, based on the experience of teachers related to signal conditions in the Gresik and surrounding areas, Google Meet can be a good alternative in learning. Based on this, this research uses the PQ4R strategy with the Google Meet platform in learning set material.

Phase *design* aims to design or design learning tools and research instruments needed . The lesson plans are prepared ×for 30 minutes for each meeting, because based on input from the mathematics teacher at Public Junior High School 1 Duduksampeyan Gresik, during online learning the learning time is determined to be 30 minutes for 1 lesson hours. The learning flow is adjusted to the PQ4R strategy steps, starting with a quick reading activity (*preview*) followed by reading in detail and thoroughly the description of the material in the student worksheet provided (*read*). Furthermore, based on the readings learned, students solve problems in the student worksheet (*reflect*), ask questions that have not been understood (*question*), discuss together in class discussion (*recite*) and end with activities to conclude the material that has been studied (*review*). While the student worksheet is structured into two parts, namely reading which contains subject matter and problem solving.

Realization or construction **phase** is the realization of the previous phase, where prototypes of learning tools and instruments were made . Figure 1 below will show the view of the developed lesson plan.



RENCANA PELAKSANAAN PEMBELAJARAN

Sekolah	: SMP	Kelas/Semester	: VII / 1	KD	: 3.4 dan 4.4
Mata Pelajaran	: Matematika Wajib	Alokasi Waktu	: 2 x 30 menit	Pertemuan ke	: 1
Materi	:	Himpunan			

A. TUJUAN PEMBELAJARAN

Melalui strategi PQ4R (*Preview, Question, Read, Reflect, Recite* dan *Review*), peserta didik dapat :
1. menjelaskan definisi himpunan menggunakan bahasa sendiri dengan tepat secara mandiri.
2. membuat contoh dan bukan contoh himpunan dengan benar dan teliti.
3. menyajikan himpunan dengan cara mendaftar anggotanya dan notasi pembentuk himpunan dengan benar dan teliti.
4. menyelesaikan masalah kontekstual yang berkaitan dengan himpunan dengan benar dan bertanggung jawab.

B. KEGIATAN PEMBELAJARAN

MEDIA	• *WhatsApp, Google Meet, Quizizz*, dll. • Slide presentasi (ppt)	ALAT	• Laptop, handphone, tablet, dan lain-lain.	SUMBER	• Buku guru dan siswa • LKPD dan internet

Kegiatan Pembelajaran	Strategi PQ4R	Alokasi Waktu
Kegiatan Pendahuluan 1. Siswa diminta untuk bergabung dalam link *Google Meet* yang diberikan oleh guru melalui *WhatsApp* grup. 2. Siswa dan guru bersama-sama melakukan doa. 3. Guru mengecek kehadiran siswa dan juga menanyakan kondisi siswa baik kesehatan maupun sinyal pada kegiatan *Google Meet* . 4. Guru memotivasi siswa tetap semangat belajar dan selalumenjaga kesehatan di tengah pandemi *Covid-19* 5. Guru menjelaskan tujuan pembelajaran serta aktivitas yang akan dilakukan dan cara mengerjakannya		8 menit
Kegiatan Inti 6. Setiap siswa membuka mengunduh file LKPD 1 yang telah di share di *chat* atau *WhatsApp* grup 7. Guru mengarahkan siswa membaca sekilas petunjuk pengerjaan LKPD 1, materi dan permasalahan-permasalahan yang terdapat di dalamnya. 8. Siswa membaca sekilas konsep himpunan yang disajikan dalam bacaan materi.	*Preview*	5 menit
9. Jika ada yang tidak dipahami maka siswa dapat menyusun pertanyaan untuk ditanyakan dengan menggunakan bantuan 5W1H.	*Question*	2 menit
10. Guru memberikan petunjuk kepada siswa cara mengidentifikasi informasi penting yang diperlukan untuk mencapai tujuan pembelajaran yang hendak dicapai. 11. Siswa membaca secara aktif dengan menggarisbawahi dan mencatat informasi-informasi penting tentang konsep himpunan dalam materi yang diperlukan untuk menjawab permasalahan	*Read*	10 menit
12. Secara individu siswa menyelesaikan permasalahan dalam LKPD 1 dengan menghubungkan konsep yang ada pada bacaan serta pengetahuan yang telah dimiliki sebelumnya. Setelah selesai siswa memotret hasil pekerjaannya dan dikirimkan secara *direct message* ke *WA* guru	*Reflect*	15 menit
13. Guru menampilkan foto hasil pekerjaan siswa dan meminta siswa bersangkutan untuk mempresentasikannya sedangkan siswa lain menanggapi 14. Guru membimbing siswa membuat simpulan dari semua pembahasan permasalahan yang didiskusikan sekaligus memberi penguatan 15. Guru meminta siswa untuk menyelesaikan kuis yang disajikan dalam *quizizz*	*Recite*	15 menit
Kegiatan Penutup 16. Siswa membaca kembali simpulan yang telah dibuat. 17. Guru menyampaikan materi yang akan dipelajari untuk pertemuan yang akan datang 18. Guru memimpin doa dan mengucapkan salam penutup serta mengingatkan siswa agar tetap menjaga kesehatan dan tetapsemangat meskipun belajar dari rumah.	*Review*	5 menit

Figure 1. PQ4R Learning Strategy Lesson Plans in Distance Learning Mathematics

The next learning tool developed is the student worksheet. An overview of reading activities in the student worksheet can be seen in Figure 2 below.

Figure 2. Reading Activities in Student Worksheet

The next activity is to practice solving some of the problems given as shown in Figure 3. Students are expected to be able to use the knowledge gained from reading earlier to solve problems. This is important as a measuring tool for whether students can understand and apply the concepts they have read (*reflect*).

To assist students in solving problems, student worksheet is equipped with work instructions and a place to fill in the answers. So students can directly write down the results of their work without having to copy them on another paper.

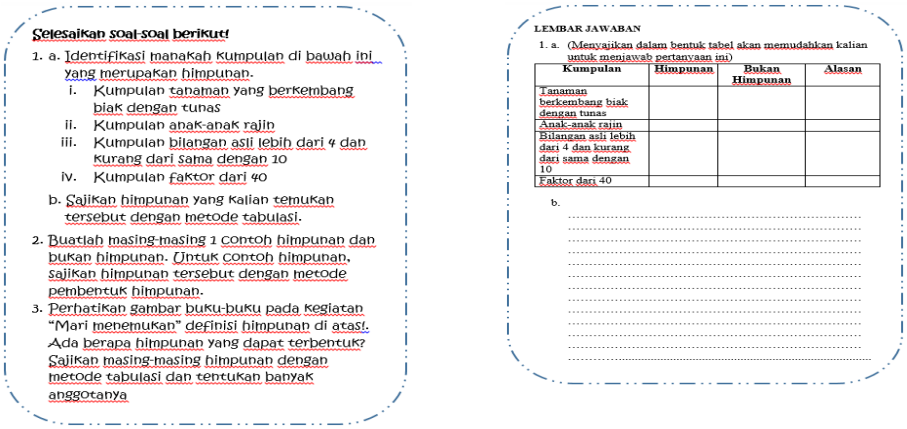


Figure 3. Problem Solving Activities in Student Worksheet

***Test, evaluation and revision* phase** is the phase of scoring on learning devices that will be developed with valid, practical and effective criteria. Analysis of data from validation results and practicality of lesson plan 1 and lesson plan 2 can be summarized in Table 6 below:

Table 6. The Results of The Validation and Practicality of The Lesson Plan

Aspect		Average Score from Validator		Total Average of Each Component	Total Average of Each Aspect
		lesson plan 1	lesson plan 2		
Validation	Destination	3.92	4	3.96	3.78
	Theory	3.59	3.67	3.63	
	Contents	3.86	3.86	3.86	
	Evaluation	3.89	3.89	3.89	
	Time	4	4	4	
	Language	3.33	3.33	3.33	
Practicality		3.93	3.93	3.93	3.93

Based on Table 6, it appears that all distance learning mathematics lesson plans developed using the PQ4R learning strategy are included in the valid category . This shows that the lesson plans have the formulation of core competence, basic competencies, indicators and learning objectives that are

mutually compatible. The results of the analysis of the practicality of the lesson plans obtained from the validator show that the average practicality value is 3.93. So it can be concluded that all lesson plans are said to be practical because they can be used with little revision. The lesson plans have to go through a few revisions to perfect the learning steps that are carried out *online* , especially the preliminary activities that are implemented with the help of the *Google Meet* and *WhatsApp platforms.* Meanwhile, other indicators such as activities that represent components in the PQ4R strategy (*preview, question, read, reflect, recite and review*) which are also designed *online* have been declared possible to be implemented in schools. So it can be concluded that all the developed lesson plans are **valid and practical.**

Data analysis of the results of the validation and practicality of student worksheet 1 and student worksheet 2 can be summarized in Table 7 below:

Table 7. Student Worksheet Validation Results And Practicality

Aspect		Validator Score Average		Total Average of Each Component	Total Average of Each Aspect
		student worksheet 1	student worksheet 2		
Validation	Destination	4	3.89	3.95	3.87
	Contents	3.8	3.87	3.84	
	Theory	3.89	3.89	3.89	
	Design	3.86	3.86	3.86	
	Language	3.67	3.67	3.67	
	Time	4	4	4	
Practicality		3.92	3.92	3.92	3.92

Based on the results of the student worksheet validation in Table 7, it appears that the developed student worksheet is included in the valid category. Student worksheet is also considered to have an attractive design with proper coloring, illustrations that help understanding, selection of appropriate letters and a neat layout of the sections. The language used also uses standard and communicative language so it is not boring to read. On the other hand, the results of the practicality analysis of the student worksheet show an average practicality value of 3.92. So it can be concluded that the developed worksheets can be said to be

practical for use in distance learning on set material. All validators stated that the material and assignments contained in the student worksheet were presented in a coherent manner to make it easier for students to learn it. So it can be concluded that all the student worksheet developed are in the **valid and practical categories.**

The effectiveness of the learning tools developed were analyzed based on aspects of student responses, learning outcomes and the implementation of learning steps. Student responses were obtained from the results of the response questionnaires distributed after the learning process was completed. The results of the student response questionnaire can be seen it appears that the average response of students reached 83.69% which indicates a **very positive response** . This indicates that the majority of students feel happy to take part in distance learning using the PQ4R learning strategy. The positive response of students regarding the application of the P4QR learning strategy in learning mathematics also occurred in the research conducted by Yuliana & Fajriah (2013).

On the other hand, the results of data analysis from the observation sheet on the implementation of the learning steps showed that 100% of the activities planned in the lesson plan and student worksheet, either through *Google Meet*, *Whatsapp* and *Quizizz*, could be carried out very well. This is in line with several studies which show that the PQ4R learning strategy is easy for teachers to apply in learning mathematics (Farapatana, Anwar, & Abdillah, 2019; Maulyda, Fauzi, Affandi, Haryati, & Istiningsih, 2020; Romiati & Theis, 2017) .

Very positive student responses and very well implemented learning steps certainly have an impact on student learning outcomes. Data on student learning outcomes obtained using the learning outcomes test instrument is presented in figure below.

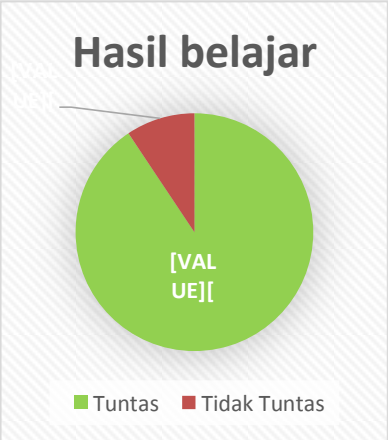


Figure 4. Data On Student Learning Outcomes

Based on Diagram , This means that as many as 29 out of 32 students get test scores ≥75 . While 9.37% of students who have not completed because they do not collect the test results of learning. These results certainly strengthen previous research which states that the PQ4R learning strategy can improve students' mathematics learning outcomes (Farapatana, Anwar, & Abdillah , 2019; Maulyda, Fauzi, Affandi, Haryati, & Istiningsih, 2020; Yuliana & Fajriah, 2013).

Based on the analysis of the data above, which concluded that the student's response was very positive, the implementation of the learning steps was very good and the student's learning outcomes were very good, the learning tools developed were declared **effective.**

CONCLUSION

The results of the preliminary research phase indicate that it is necessary to develop distance learning tools that can facilitate direct communication between teachers and students so that learning outcomes can be improved. In the design and *realization or construction phases,* lesson plan and student worksheet were developed for distance learning that followed the steps of the PQ4R learning strategy (*Preview, Question, Read, Reflect, Recite and Review*) assisted by the Google Meet application. Furthermore, based on the results of the *test, evaluation and revision phase,* it was found that the developed lesson plan and student worksheet were valid and practical. Meanwhile, the average practicality of lesson

plan and student worksheet is 3.93 and 3.92, respectively. The developed lesson plan and student worksheet can be seen from the results of the implementation of the syntax of learning mathematics which is included in the very good category with a percentage of 100% , the response of students after participating in the learning is very positive and the learning outcomes of students are included in the very good category with a percentage of completeness of 90.63 % .

Suggestions for other researchers who want to research the same study can try learning activities that use group division and small group discussions so that students' communication and collaboration skills become better because the devices currently being developed still prioritize individual work.

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