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Enhancing conceptual understanding and learning skills: The role of strategy, motivation, teacher support, and self-efficacy

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Abstract

Background: Effective learning involves more than mere exposure to information; it requires learners to engage strategically, be motivated, and operate within supportive environments. In junior high school science education, students often face challenges in developing a deep conceptual understanding and acquiring scientific skills. Addressing this issue calls for the implementation of learning strategies that promote active engagement and student-centered learning.
Aim: This study aims to investigate the impact of the Reading, Questioning, and Answering (RQA) learning strategy on students' conceptual understanding and science learning skills. It also explores the role of learning motivation, teacher support, and self-efficacy in supporting students' learning processes.
Method: A quantitative research design was employed, utilizing the Partial Least Squares (PLS) analysis approach. The sample consisted of 40 junior high school students selected through a saturated sampling technique. Data were gathered through questionnaires, classroom observations, and documentation, and analyzed using SmartPLS software to assess the relationships among the studied variables.
Result: The results revealed that the RQA learning strategy significantly influences students' conceptual understanding and science learning skills. While learning motivation, teacher support, and self-efficacy also have positive effects, the RQA strategy was identified as the most influential factor in enhancing science learning outcomes.
Conclusion: The findings underscore the importance of innovative and student-centered learning strategies, such as RQA, in improving science education at the junior high school level. These insights are valuable for educators and curriculum developers in designing more interactive and supportive learning environments that foster deeper understanding and scientific competence among students.

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INTRODUCTION

The ever evolving landscape of education, the demand for effective learning strategies that enhance students' understanding of concepts and skills has grown significantly (Rauf et al., 2021; Wongsa & Cojorn, 2024). As educators and researchers strive to improve student outcomes, innovative teaching methods have emerged as essential tools for fostering intellectual growth and academic success. Among these methods, Reading, Questioning, and Answering (RQA) learning strategies have gained attention for their potential to transform classroom dynamics and empower learners. This study delves into the impact of RQA strategies, combined with learning motivation,

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teacher support, and self-efficacy, on the academic performance of junior high school students (Aisya et al., 2023; Usyan et al., 2022).

The RQA learning strategy emphasizes active student participation through guided reading, critical questioning, and reflective answering. Unlike traditional lecture-based approaches, RQA promotes deeper engagement with learning materials, encouraging students to analyze, synthesize, and apply knowledge in meaningful ways. This interactive and student-centered approach aligns with contemporary educational philosophies that prioritize active learning and critical thinking. As such, understanding the effects of RQA on student outcomes is pivotal for advancing pedagogical practices (Oje et al., 2025; Pedagogical, 2025).

Learning motivation serves as a driving force behind student achievement, shaping their attitudes toward education and their capacity for sustained effort. High levels of motivation enable students to persevere through challenges and approach learning with enthusiasm and curiosity. Similarly, teacher support plays a crucial role in creating a nurturing environment that fosters positive student-teacher relationships and enhances academic engagement (Picciano, 2017). Both motivation and support are integral to the success of innovative learning strategies like RQA. Another key factor influencing academic performance is self-efficacy, or the belief in one's ability to achieve specific goals. Students with strong self-efficacy are more likely to approach learning tasks with confidence and resilience, ultimately enhancing their understanding and skills. When combined with RQA strategies, self-efficacy may amplify the effectiveness of the learning process, providing students with the tools they need to excel in science education. Exploring this relationship offers valuable insights into the multifaceted nature of student achievement (Nguyen, 2015).

Effective learning is one of the important keys in improving the quality of education. In the current era of globalization, the challenges in the world of education are increasingly complex, so learning strategies that are able to develop various aspects of students' abilities, including concept understanding and metacognitive skills are needed (Diani et al., 2019; Ridwanulloh et al., 2022; Ramadhani, et al., 2019). Education in the modern era demands a more innovative approach and is centered on the development of critical thinking skills and a deep understanding of concepts. One of the approaches that is now widely applied in the learning process is the RQA (Reading, Questioning, and Answering) learning strategy. This strategy is designed to optimize the student learning process through three main stages, namely reading, asking, and answering, so that it can train students to think critically and independently. In the context of education in Junior High School, the implementation of effective learning strategies is important, considering that students at this level are in an important phase of their cognitive development (Huda et al., 2019).

In addition to learning strategies, two other important factors that also affect students' success in the learning process are learning motivation and self-efficacy. Learning motivation refers to internal and external impulses that affect students' enthusiasm and intensity in participating in learning activities. High motivation will encourage students to be more active and enthusiastic in understanding the subject matter. Self-efficacy, on the other hand, is students' confidence in their ability to complete assignments or face academic challenges. Students with high self-efficacy tend to have strong confidence in solving problems and mastering the concepts given (Diani et al., 2019; Yasin et al., 2020).

Metacognitive skills, or the ability to manage the process of thinking and learning on their own, are one of the essential skills that need to be developed in students. With these skills, students not only passively understand the material, but are also able to organize and monitor their own understanding. On the other hand, concept understanding is an important measure in assessing the extent to which students are able to master the subject matter comprehensively. By using the right RQA strategy, coupled with high learning motivation and self-efficacy, it is hoped that students can develop better metacognitive skills and concept understanding (Diani et al., 2019; Ridwanulloh et al., 2022; Yasin et al., 2020).

Support from teachers also has a crucial role in creating a conducive learning environment. Teachers not only act as facilitators who assist students in understanding the material, but also provide the moral support and motivation that students need in developing their study skills. Therefore, a good understanding of concepts and metacognitive skills can be strengthened with effective support from teachers (Huda et al., 2019, 2020; Pertiwi, et al., 2019; Ramadhani, et al., 2019).

This study aims to analyze the influence of RQA learning strategies, learning motivation, and self-efficacy on concept understanding, metacognitive skills, and support provided by teachers to MTs (Madrasah Tsanawiyah) students. Through this research, it is hoped that effective strategies can be found to improve the quality of learning and student self-development, so that it can be a reference for educators in designing a more optimal learning process. Problem Formulation there are: 1) How does the RQA learning strategy affect the understanding of junior high school students' concepts? 2) What is the relationship between the influence of RQA (reading, questioning, and answering) learning strategies, learning motivation, teacher support, and self-efficacy on students' understanding of concepts and learning skills?

The findings of this study underscore the importance of innovative and student-centered learning strategies in optimizing educational quality. By highlighting the role of RQA, motivation, teacher support, and self-efficacy, this research offers practical implications for educators and curriculum developers seeking to enhance science learning at the junior high school level. The insights gained from this study serve as a foundation for designing more interactive and learner-focused educational models, paving the way for improved academic performance and lifelong learning.

METHOD

This study uses a quantitative method with a survey approach to analyze the influence of RQA (Reading, Questioning, and Answering) learning strategies, learning motivation, teacher support, and self-efficacy on the understanding of concepts and learning skills in science lessons in junior high school. Data was collected through the distribution of questionnaires that measured these variables to junior high school students involved in the study. To analyze the data, this study uses SEM-PLS (Structural Equation Modeling-Partial Least Squares) analysis to test the relationship between the variables involved, as well as evaluate the validity and reliability of the measurement and structural models (Eveland et al., 2024; Schubring et al., 2016). The results of this SEM-PLS analysis are expected to provide an overview of how much influence each variable has on improving students' understanding of concepts and learning skills in science lessons (Munifah et al., 2019; Prastowo et al., 2019).

In this study, the sample used was 40 students. Sampling uses filling out a questionnaire using a measuring tool in the form of the Likert scale, which is a measurement method used to measure an attitude, opinion, or perception of a person or group regarding a social phenomenon or event (Dewar & Walker, 1999; Nguyen, 2015; Putri et al., 2025). The purpose of this saturated sampler is to provide deeper insights and allow for a lower margin of error on the result research. The data collection techniques in this research are in the form of questionnaires, observations, documentation and interviews. Research instruments are tools designed to simplify the process of collecting data needed in a research. This instrument is designed and arranged systematically before research activities begin, by referring to the indicators in the research variables. In this study, the instrument will be compiled based on indicators related to the mastery of 21st century skills, namely the 4C skills (Critical Thinking, Communication, Collaboration, and Creativity), as well as the effectiveness of the implementation of the Project-Based Learning learning model as explained in the previous chapter (Dimov, 2021).

Data Collection

The collection of data on problem-based learning variables was carried out by providing a set of written statements to respondents in the form of indicators about the effectiveness of the project-based learning model. The instrument is packaged in the form of a questionnaire given to students to be filled in according to their respective answers. The purpose of the questionnaire was to find out the students' responses to the problem based learning model so that the researcher could find out clearly through the respondent's point of view about the effectiveness of the learning model. The respondents in this study were all students of class 8D and 8F SMPN 1 Papar with a total of 40 students. The instrument was given after learning with the problem-based learning model was completed.

Analysis Data

The analysis in this study uses a tool, namely Patrial Least Square (PLS) software. This research was conducted at SMPN 1 Papar which is located on Jalan Raya Papar No. 119, South Papar, Kediri Regency, Indonesia. The research was conducted for the first time on November 18, 2024. After previously confirming and applying for permission to conduct research at the school. The extraction of information in this study is carried out in several ways, including observation, questionnaire and documentation.

The type of instrument used in this study is a questionnaire. This questionnaire instrument is divided into two types based on the purpose of data collection. The first questionnaire was designed to measure the effectiveness of the implementation of the Project-Based Learning learning model in science subjects. This questionnaire is compiled in the form of relevant statements, and the respondents are students. Thus, through this first questionnaire, information can be obtained about student responses to the implementation of the learning model. The second questionnaire is designed to measure the level of mastery of students' 4C skills. This questionnaire is compiled into four parts, where each part is focused on each skill, namely Critical Thinking, Communication, Collaboration, and Creativity. This second questionnaire will be filled out by teachers or researchers, which aims to evaluate the extent to which students master these skills during the project-based learning process (Coletta & Steinert, 2020; License, 2024; Malik et al., 2025; Noura, 2024).

Both types of questionnaires use the Likert scale as a measuring tool. On the Likert scale, the variables to be measured are decomposed into specific indicators which are then used as the basis for compiling statement items in the questionnaire. In the first questionnaire, students' responses to statements were given through a choice of answers with gradations ranging from strongly agreeing, agreeing, hesitating, disagreeing, to strongly disagreeing, each of which had consecutive scores of 5, 4, 3, 2, and 1. Meanwhile, in the second questionnaire, the answers were given with a gradation that showed the level of skill of the students, ranging from very good, good, enough, less, to very poor.

Tabel 1. 4C Skill mastery likert scale research item

Choice of Answer	Score
Strongly agree	5
Agree	4
Nervous	3
Disagree	2
Strongly disagrees	1

This study tested the validity of the instrument by utilizing SmartPLS 3.0 software. The purpose of this test is to determine whether the questionnaire used in the study has met the established validity standards. A construct or variable is considered valid if the Corrected Item Total Correlation value is greater than 0.3. To ensure this, the instrument was first tested on a group of respondents who did not belong to the primary study population. This trial involved 40 students who were selected with the same criteria as the research population, namely 8th grade junior high school students. In addition, the learning process during the trial was also adjusted to the learning in the research, namely science learning using the problem-based learning model (Cheah et al., 2023; Richter & Tudoran, 2024; Sarstedt et al., 2022).

The reliability test in this study uses Cronbach's Alpha method. An instrument is declared reliable if it has a Cronbach's Alpha value of at least 0.7. However, higher values, such as 0.8 or 0.9, are considered more ideal. In addition, the composite reliability value is also an important indicator, with the value criterion having to be greater than 0.7 for the instrument to be considered reliable. These values indicate a good level of consistency and accuracy of the instrument in measurement (Fauzi, 2022; Hair & Alamer, 2022; Sarstedt et al., 2021). To simplify the testing process, Smart PLS 3.0 software is used as a tool. The procedure in this study is divided into three stages, namely: preparation stages, research stage, and analysis stage.

Preparation Stages

The preparation stage is a stage carried out by the researcher before conducting a research. This stage consists of:

a. Background determination.
b. Formulating problems based on literature review
c. Setting research objectives.
d. Formulate a hypothesis.
e. Determine the research design
   1) Method selection
   2) Determination of variables and data sources.
   3) Selection of instrument type
f. Instrument Preparation.
g. Test the validity and rehabilitation of the instrument.

Research stage

At this stage, the researcher begins the research with the following stages:

a. Carry out learning with a project-based learning model.
b. The data collection process is through observation and questionnaires.
c. Develop a hypothesis based on model specifications.

Analysis stage

After all the data from the questionnaire was obtained, the data began to be analyzed using SEM-PLS. Data analysis using SEM-PLS consisted of three steps. The first step to see the validation and reliability of the instrument, is called the measurement model or outer model. The second step to analyze the data according to the hypothesis proposed, is called the structural model or inner model. The third step is to test the hypothesis with bootstrapping.

In this study, data analysis uses the Patrial Least Squere (PLS) approach. PLS is a Structural Equation Modeling (SEM) equation model that is based on components or variants. PLS is an allergic approach that shifts from a covariant-based SEM approach to a variant-based approach. In this study, data analysis was carried out using the Partial Least Square (PLS) approach, which is an analysis method based on the Structural Equation Modeling (SEM) model that utilizes components or variants (Fauzi, 2022; Sarstedt et al., 2021). This approach is an alternative to covariant-based SEM with a shift in focus from theoretical and causality testing to predictive model development. This makes PLS more suitable for research that emphasizes predictive ability rather than theoretical proof. As already mentioned, in this case, data analysis is carried out in 3 stages, namely measurement model, structural model and hypothesis testing (Hair & Alamer, 2022; Richter & Tudoran, 2024).

1. Outer Model (Measurement Model)

The analysis of the outer model is carried out to ensure that the measurements used are worthy of being used as measurements (valid and reliable). In this model analysis, the relationship between latent variables and their indicators is specified (Basar et al., 2021; Coletta, 2023; Febrianti et al., 2024). The analysis of the outer model can be seen from several indicators:

a. Convergenr validity test

From the measurement model with the reflective model of the indicator assessed based on individual testing, the reability item is used a standardized loading factor which describes the magnitude of the correlation between each indicator and its construction. A loading factor value above 0.70 is expressed as an ideal or valid measure as an indicator that measures the construct. However, for the initial stage of research from the development of the loading value measurement scale, 0.50 to 0.60 is considered quite adequate (Yadlowsky et al., 2020). The higher the value of the loading factor, the more important the role of loading in interpreting the factor matrix.

b. Descriminant validity test

To test whether the indicators of a construct are not highly correlated with the indicators of other constructs. The discriminant validity of the measurement model with reflective indicators is assessed based on the cross-loading measurement with the construct. If the correlation of the construct with the measurement item is greater than the size of the other construct, then it indicates that the latent construct predicts the size on the block better than the size of the other block. Another method to find discriminant validity is to compare the square root value of the AVE (√AVE) of each construct with the value of the correlation between the construct and the other constructs (latent variable correlation) (Rozikin et al., 2021).

c. Composite validity test

As a better method compared to the Cronbach alpha value in testing reliability in the structural equation modeling model. Composite reliability, which measures a construct, can be evaluated with two measures, namely internal consistency and cronbach's alpha.

d. Cronbach's alpha test

It tends to be a lower bound estimate in measuring reliability, while composite reliability does not assume reliability. Composite reliabiliy is a closer approximation assuming that the parameter estimation is more accurate. The composite reliability interpretation is the same as Cronbach's alpha where a limit value of 0.7 and above is acceptable.

2. Inner Model (Structural Model)

a. ƒ2 Effect Size Test

Changes in the R2 value can be used to assess the influence of exogenous latent variables on endogenous variables whether they have a substantive influence, which is measured through Effect Size ƒ2, and expressed in the form of the following equation 1.

$$\frac{f^2 = R^2 included - R^2 excluded}{1 - R^2 included} \quad \ldots (1)$$

Where R2included and R2excluded are the R2 values of the endogenous latent variables obtained when the exogenous variables enter or are excluded from the model. The inter performance of the ƒ2 value is the same, which is 0.02, has a small effect; 0.15 has a moderate influence and 0.35 has a large influence on the structural level.

b. Stone-Geisser Test (Q2)

In addition to looking at the size of the R2 value, the PLS model was evaluated by looking at Q2 predictive relevance to measure how well the observation value was generated by the model and also the estimation of its parameters (Reyes et al., 2024). A Q2 value greater than 0 indicates the model has predictive relevance, while less than 0 indicates the model has no predictive relevance and expressed in the form of the following equation 2.

$$Q^2 = 1 - \frac{\sum DED}{\sum DOD} \quad \ldots (2)$$

Where *D* is the omission distance; *E* is the sum of squares of prediction error; *O* is the sum of square errors using the mean for prediction; *A* value of $Q^2 > 0$ indicates that the model has predictive relevance, while The $Q^2 < 0$ value indicates that the model lacks predictive relevance.

c. Test Goodness of Fit (Gof) index

To validate the model as a whole, the Goodness of Fit (GoF) index is used as the GoF index. The index was developed to evaluate measurement models and structural models and in addition to providing simple measurements for the overall prediction of the model (Eloranta et al., 2024). For this reason, the GoF Index is calculated from the square root of the average communality index and the average R-Square as follows equation 3.

$$GoF = \sqrt{\frac{mean}{Comx\, R^2}} \quad \ldots (3)$$

Striped com is the average communalities; Striped R2 is the average of the R2 model; The GoF value is between 0 to 1, with a communality value of recommended 0.50 and R square value then with an interpretation value of 0.10 included in the small Gof level, 0.25 medium Gof value, 0.36 large Gof value.

3. Hypothesis Testing

In hypothesis testing, it can be seen from the t-statistical value and probability value. For hypothesis testing, namely by using statistical values, for alpha 5% the *t-statistical* value used is 1.684. So that the criteria for acceptance/rejection of the hypothesis are Ha accepted and H0 rejected when *t-statistical* >1.684. To reject/accept the hypothesis using probability, Ha is accepted if the P-Value < 0.05.

RESULTS AND DISCUSSION

The condition of the students at the time of filling out the questionnaire was still in a state of enthusiasm and conduciveness (Cheah et al., 2023; Sarstedt et al., 2022). This is because during the learning process through PBL, students do a lot of activities so that learning does not seem boring. So this situation is considered to be able to minimize the invalidity of each student's questionnaire answers. Based on the answers from the statements related to the problem based learning model, it will be described as in **Figure 1**.

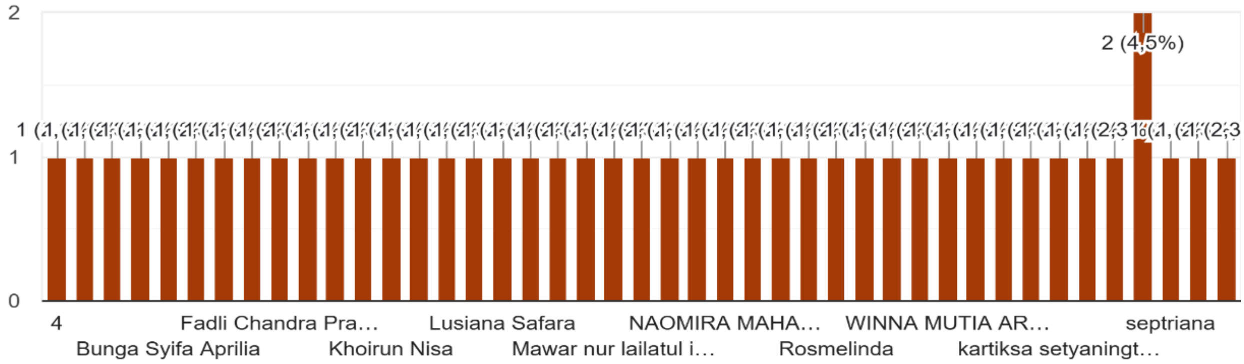

Figure 1. RQA (Reading, Questioning, and Answering) Learning.

In **Figure 1** it can be seen that: From the data, students agree that RQA (Reading, Questioning, and Answering) can help understand the lesson and provide new knowledge. A total of 44 respondents from the number of students agreed that RQA can encourage students to be more active and enterprising in learning As many as 95% of the number of students agree that RQA can build a sense of responsibility for the tasks given. Outer model analysis defines how each indicator relates to its latent variable.

Convergent Validity

Convergent validity is a critical aspect of construct validity in Structural Equation Modeling (SEM) using Partial Least Square (PLS) analysis. It assesses whether the indicators (observed variables) of a latent construct are strongly correlated and measure the same concept effectively. This ensures the internal consistency and reliability of the measurement model. Convergent Validity aims to determine the validity of each relationship between an indicator and its construct or latent variable. The convergent validity of the measurement model with indicator reflexives is assessed based on the correlation between the item score or component score and the latent variable score or construct score estimated with the PLS program. The expected value exceeds the number 0.7 as the minimum limit of the loading factor value **(Figure 2)**.

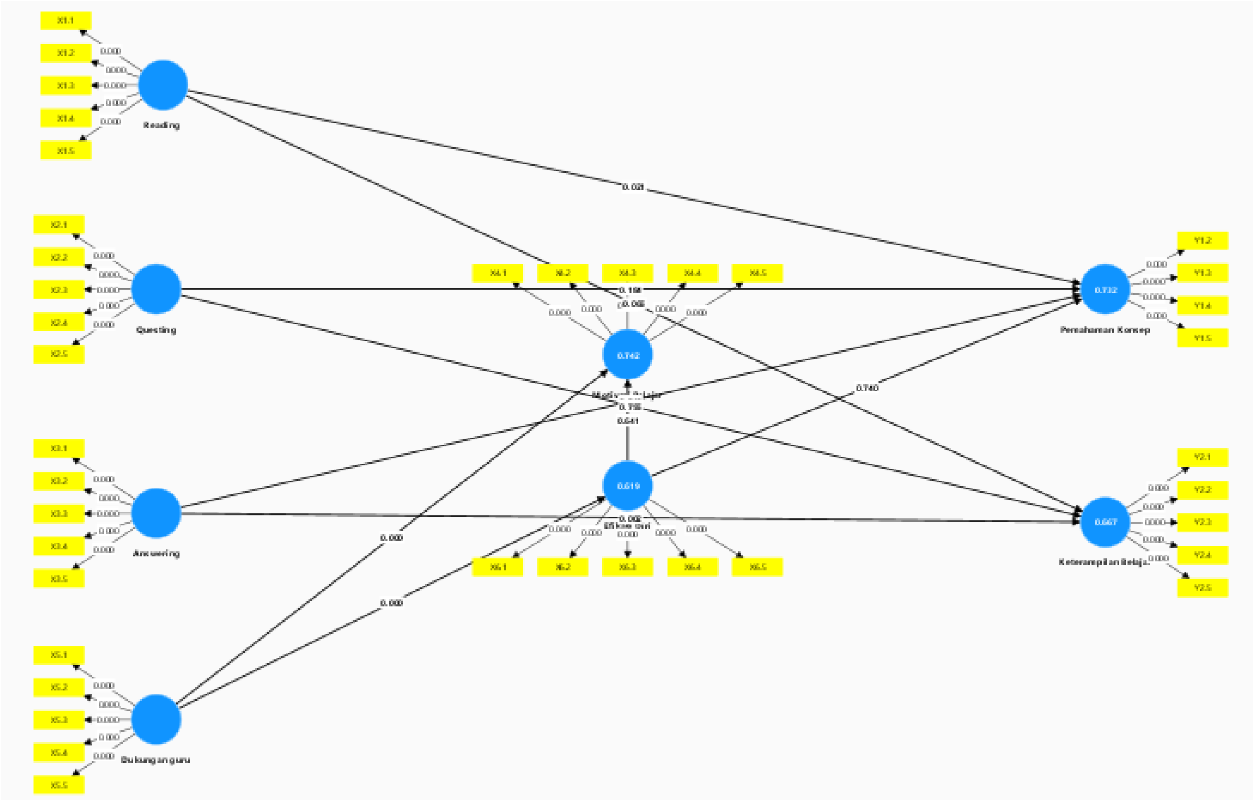

Figure 2. The calculation results of the SEM PLS model

In **Figure 3**, it can be seen that the majority of indicators in each variable in this study have a loading value of > 0.7. This shows that variable indicators that have a loading value of > 0.7 have a high level of validity, so they meet convergent validity. Meanwhile, variable indicators that have a loading value of < 0.7 have a low level of validity so that the variable indicator needs to be eliminated or removed from the model. From the results of data processing with SEM PLS seen in **Figure 3**, it shows that all indicators have a loading value greater than 0.7. This means that all indicators have a high level of validity, thus meeting convergent validity. Thus, the analysis continues to the discriminant validity test.

The key steps to assess convergent validity in SEM PLS include factor loadings, average variance extracted (AVE), and composite reliability (CR). Convergent validity is demonstrated when each indicator has a high loading (commonly greater than 0.7) on its respective latent construct. Loadings below this threshold may indicate weak relationships between the indicators and the construct. AVE is another key criterion for convergent validity. It measures the proportion of variance in the indicators explained by the latent construct. A threshold of AVE ≥ 0.5 is widely accepted, indicating that the construct explains at least 50% of the variance in its indicators. For Composite Reliability (CR), the primarily a measure of reliability, CR complements AVE by ensuring the internal consistency of a construct. Values exceeding 0.7 are considered acceptable (Oje et al., 2025).

In examining the constructs such as RQA learning strategies, teacher support, and self-efficacy, the indicators (e.g., survey items or observation categories) must exhibit sufficient factor loadings, AVE, and CR values to confirm convergent validity. The indicator of RQA strategies should strongly reflect activities like guided reading, critical questioning, and reflective answering. While the indicator of learning motivation might assess students' enthusiasm, effort, and persistence toward tasks. Establishing convergent validity ensures the robustness and credibility of the SEM model used in your research. If needed, poorly performing indicators can be removed or re-evaluated to improve model fit (Hu et al., 2025; Wang et al., 2025).

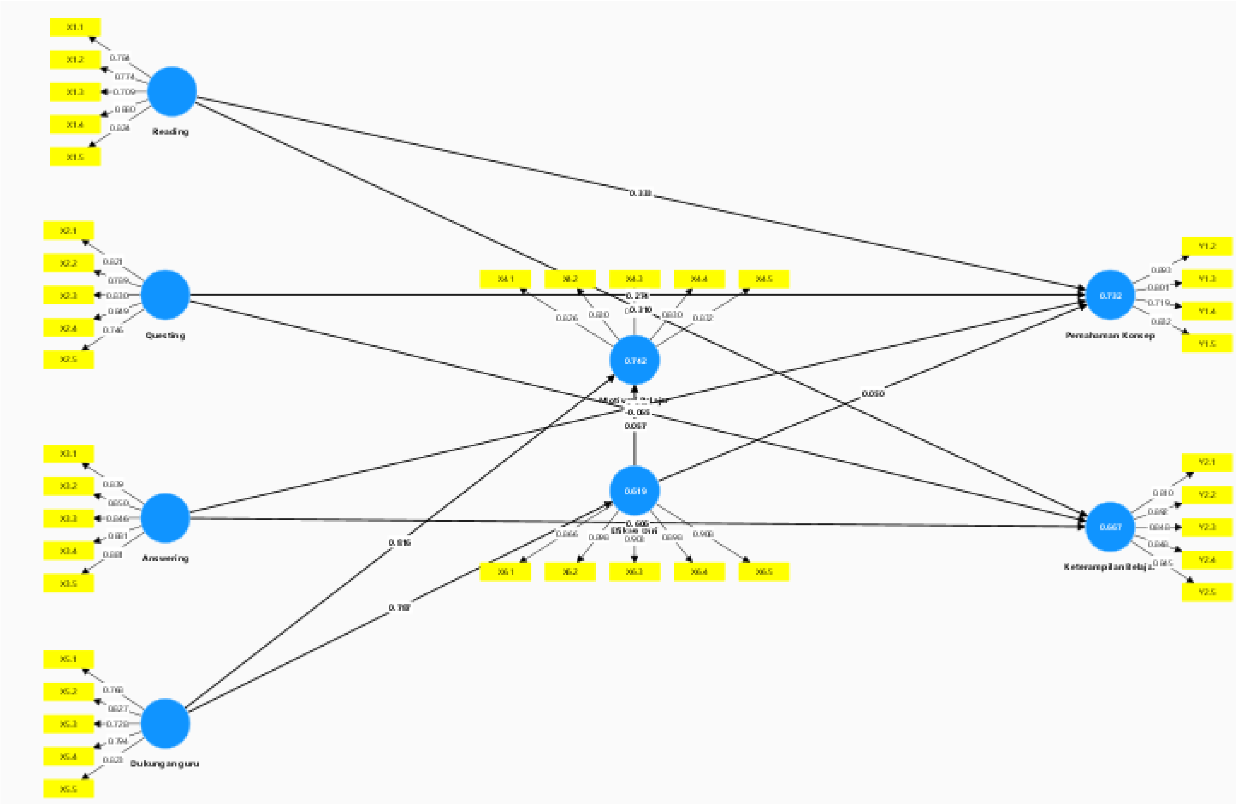

Figure 3. Convergent Validity after Modification (Source: Smart PLS Program)

Discriminant Validity

Discriminatory validity is used to ensure that each concept of each of the constructs or latent variables is different from the other variables. At the indicator level, the validity of this discrimination can be known through the cross loading value, where the loading indicator on the intended construction must be greater than the loading value on other constructs. The following **Table 2** will be presented that shows the results of the validity of discrimination from the research model by looking at the cross loading value.

Table 2. Cross loading values results

Indicators	Reading	Questioning	Answering	Learning Motivation	Teacher Support	Self-efficacy	Understanding the concept	Study Skills
X1.1	0,784	0,636	0,562	0,594	0,592	0,360	0,572	**0,479**
X1.2	0,774	0,763	0,674	0,755	0,704	0,450	0,653	**0,481**
X1.3	0,709	0,502	0,567	0,737	0,542	0,479	0,495	**0,641**
X1.4	0,880	0,757	0,705	0,761	0,623	0,528	0,792	**0,695**
X1.5	0,824	0,670	0,677	0,712	0,681	0,541	0,653	**0,629**
X2.1	0,643	0,821	0,685	0,633	0,619	0,333	0,624	**0,501**
X2.2	0,672	0,789	0,691	0,677	0,665	0,372	0,634	**0,538**
X2.3	0,660	0,830	0,716	0,630	0,699	0,522	0,664	**0,558**
X2.4	0,753	0,849	0,711	0,627	0,609	0,490	0,672	**0,652**
X2.5	0,650	0,746	0,718	0,665	0,654	0,511	0,672	**0,653**
X3.1	0,603	0,754	0,839	0,658	0,674	0,564	0,659	**0,573**
X3.2	0,725	0,783	0,850	0,668	0,686	0,552	0,657	**0,633**
X3.3	0,680	0,655	0,846	0,721	0,744	0,672	0,682	**0,670**
X3.4	0,671	0,783	0,881	0,742	0,731	0,669	0,696	**0,756**

X3.5	0,765	0,780	0,881	0,789	0,723	0,664	0,763	**0,773**
X4.1	0,769	0,662	0,756	0,826	0,736	0,673	0,651	**0,655**
X4.2	0,738	0,645	0,617	0,830	0,678	0,431	0,634	**0,540**
X4.3	0,700	0,706	0,717	0,749	0,693	0,569	0,702	**0,752**
X4.4	0,643	0,552	0,675	0,830	0,687	0,640	0,611	**0,585**
X4.5	0,788	0,692	0,626	0,832	0,703	0,518	0,721	**0,643**
X5.1	0,577	0,782	0,727	0,565	0,768	0,548	0,654	**0,662**
X5.2	0,669	0,663	0,597	0,765	0,827	0,532	0,696	**0,641**
X5.3	0,607	0,697	0,724	0,725	0,728	0,481	0,727	**0,614**
X5.4	0,644	0,504	0,578	0,648	0,794	0,725	0,571	**0,564**
X5.5	0,608	0,573	0,666	0,685	0,823	0,780	0,531	**0,603**
X6.1	0,481	0,456	0,570	0,567	0,695	0,866	0,520	**0,756**
X6.2	0,552	0,465	0,671	0,624	0,666	0,898	0,526	**0,703**
X6.3	0,602	0,574	0,725	0,669	0,745	0,908	0,602	**0,710**
X6.4	0,506	0,470	0,651	0,604	0,677	0,700	0,503	**0,671**
X6.5	0,525	0,521	0,638	0,657	0,732	0,454	0,499	**0,752**
Y1.2	0,725	0,739	0,834	0,785	0,746	0,407	0,893	**0,809**
Y1.3	0,695	0,691	0,601	0,677	0,732	0,332	0,801	**0,690**
Y1.4	0,480	0,484	0,534	0,571	0,522	0,706	0,719	**0,512**
Y1.5	0,685	0,692	0,619	0,604	0,571	0,657	0,832	**0,564**
Y2.1	0,566	0,660	0,624	0,587	0,735	0,729	0,639	**0,810**
Y2.2	0,719	0,659	0,752	0,704	0,645	0,638	0,719	**0,892**
Y2.3	0,567	0,608	0,697	0,650	0,615	0,685	0,629	**0,848**
Y2.4	0,610	0,503	0,595	0,655	0,617	0,	0,615	**0,848**
Y2.5	**0,673**	**0,639**	**0,703**	**0,714**	**0,697**	**0,**	**0,792**	**0,845**

From the results of the cross loading estimation in **Table 2**, it shows that the loading value of each indicator item against its construction is greater than the cross loading value. Thus, it can be concluded that all constructs or latent variables already have good discriminant validity, where the indicators in the construction indicator block are better than the indicators in other blocks.

Average Variance Extracted (AVE)

At the level of latent variables, the validity of criminal behavior is assessed by comparing the root value of AVE (Average Variance Extracted) of a latent variable with the correlation between a latent variable and all other latent variables. If the value of the root of AVE of a variable is greater than the correlation with another variable, then the validity of the discrimination will be considered feasible. The expected root value of AVE is > 0.5.

Table 3. Average variance extracted (AVE) score results

Variable	AVE Scores
Reading	0,634
Questioning	0,652
Answering	0,739
Teacher support	0,622
Learning Motivation	0,662
Self-Efficacy	0,801
Understanding Concepts	0,662
Study Skills	0,721

Source: *Smart partial least square program (PLS) results*

From **Table 3** it is known that the AVE value of each construct is above 0.5. Therefore, the validity of discrimination in this study is considered appropriate. Outer model In addition to being measured by assessing the validity of convergence and validity of discrimination, it can also be done by looking at the reliability of the construct or latent variable which is measured by looking at the value of the Cronbach Alpha from the indicator block that measures the construct. The construct is declared reliable if the value Cronbach Alpha greater than 0.7. The output results of the Smart PLS program for the cronbach alpha value can be seen from the following **Table 4**.

Table 4. Cronbach alpha value results

Variable	Cronbach Alpha Values
Reading	0,854
Questioning	0,866
Answering	0,912
Teacher support	0,848
Learning Motivation	0,872
Self-Efficacy	0,938
Understanding Concepts	0,829
Study Skills	0,903

Source: *Smart partial least square program (PLS) results*

Table 4 shows that the cronbach alpha value for all constructs is above the value of 0.7. Thus, it can be concluded that all constructs have good reliability in accordance with the required minimum value limit. The evaluation of the inner model can be carried out with three analyses, namely by looking at R2, Q2, and F2, as explained as follows: The R2 value indicates the degree of determination of the exogenous variable to its endogenous. The R2 value ranges from 0 to 1 with a value close to 1 indicating greater prediction accuracy. So that the R2 value > 0.25 can be said to have a high influence.

Table 5. R square value results

Exogenous Variables Against Endogenous	R Square	R Square Adjusted	Level of Determination
Self-efficacy → Motivation to learn → Understanding the concept→ Study Skills	0,619	0,610	high
Reading →Questioning → Answering	0,667	0,641	high
Learning Motivation→ Teacher Support → Self-efficacy	0,742	0,729	high
Understanding the Concept of → Reading → Questioning → Answering → Self-Efficacy	0,732	0,704	high

Source: *Smart partial least square program (PLS) results*

Table 5 demonstrates that self-efficacy, learning skills, and learning motivation all contribute to a high level of determination, with an R Square value greater than 0.25. According to the 2013 curriculum, mastering 4C skills is essential for effective learning. The Reading, Questioning, and Answering (RQA) Learning Strategy has positively impacted students' understanding of scientific concepts at SMPN 1 Papar. This strategy comprises three interconnected stages: reading, questioning, and answering.

- Reading Stage: Students independently comprehend the material before classroom learning begins, building a foundation for concept understanding.
- Questioning Stage: Students formulate questions based on the material they have read, enhancing curiosity and honing higher-order thinking skills such as analysis and evaluation.
- Answering Stage: Students discuss and answer the prepared questions individually or in groups, allowing them to correct misconceptions, reinforce understanding, and boost confidence in expressing ideas. Feedback from peers or teachers further deepens their comprehension.

At SMPN 1 Papar, the implementation of the RQA strategy has led to increased student engagement, making them more active in exploring and understanding scientific concepts like energy, the water cycle, and ecosystems.

Overall, the RQA strategy promotes meaningful learning by centering the process around students, unlike conventional teacher-centered methods. Research has shown significant improvements in student learning outcomes through concept comprehension tests and classroom activity observations following the RQA strategy's implementation. This approach not only aids in material comprehension but also equips students with independent study and critical thinking skills crucial for advanced learning.

The combined influence of RQA learning strategies, learning motivation, teacher support, and self-efficacy creates an effective learning environment for junior high school students. The RQA strategy encourages active learning through reading, questioning, and answering, thus enhancing concept understanding. However, its effectiveness is significantly influenced by internal factors, such as students' motivation and self-efficacy, and external factors, like teacher support. Learning motivation drives students to remain consistent and enthusiastic in the learning process, while self-efficacy, or students' confidence in their abilities, strengthens their mastery of challenging scientific concepts (Usyan et al., 2022).

Teacher support serves as a facilitator, providing guidance, direction, and feedback throughout the learning process. Supportive teachers create a conducive learning environment, motivate students, and help them overcome obstacles in understanding the material. When the four factors—RQA, learning motivation, teacher support, and self-efficacy work simultaneously, they create a synergy that maximizes students' potential to understand science concepts more deeply. Studies measuring this simultaneous influence typically show a significant relationship, with each variable complementing the others in explaining variations in students' conceptual understanding. This suggests that successful science learning relies on a combination of effective learning approaches, internal motivation, and supportive environments (Prastowo et al., 2019).

The simultaneous influence of RQA learning strategies, learning motivation, teacher support, and self-efficacy on junior high school students' science learning skills creates a significant synergy, fostering independent and effective learning. RQA strategies, encompassing the reading, asking, and answering stages, encourage active student participation, thereby practicing skills such as analysis, problem-solving, and critical thinking (Usyan et al., 2022). The success of this strategy is highly influenced by students' motivation to learn. Highly motivated students tend to be more diligent, focused, and eager to master the necessary study skills for understanding science lessons (Aisya et al., 2023).

Moreover, teacher support plays a crucial role in shaping students' learning skills. Teachers who offer direction, constructive feedback, and a supportive environment help students develop more effective learning strategies. Self-efficacy also has a central influence, as confident students are more motivated to tackle challenges and explore new learning methods suited to their needs. When these four factors work in tandem, they enhance students' ability to plan, manage time, and apply organized learning strategies in science lessons.

Studies measuring the simultaneous influence of these four factors often show a significant relationship with improved student learning skills. The combination of innovative learning approaches like RQA, internal motivation, active teacher support, and student confidence results in students who not only understand science material but also learn more independently and effectively. This is crucial for ensuring students can continue to develop relevant learning skills, both in school and everyday life.

CONCLUSION

Based on the research analysis, it can be concluded that the Reading, Questioning, and Answering (RQA) learning strategy significantly influences students' understanding of concepts and learning skills, particularly in science subjects. The implementation of this method, which involves reading, questioning, and answering activities, effectively increases student involvement in the learning process, both individually and in groups. Additionally, supporting factors such as learning motivation, student self-efficacy, and teacher support make important contributions to the success of this strategy. Respondents showed high enthusiasm for participating in learning, as reflected in questionnaire results, which revealed the effectiveness of the RQA method in motivating students and building a sense of responsibility for their tasks. The conducive learning environment during the questionnaire process also supported the validity of the research results. In conclusion, the RQA learning strategy has proven to be an effective approach in improving students' understanding of concepts and metacognitive skills. It can serve as a reference for implementing more interactive learning methods across various subjects.

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AUTHOR CONTRIBUTIONS STATEMENT

UFL	: Resources, Conceptualization, Methodology, Data curation, Investigation, Formal analysis, Writing – original draft, Writing – review & editing, Supervision.
SH	: Resources, Conceptualization
FCM	: Methodology, Data curation
AA	: Investigation, Formal analysis, Writing – review & editing, Supervision
LM	: Investigation, Formal analysis, Writing – review & editing
RU	: Investigation, Writing – review & editing. Ganesha Antarnusa: Investigation, Writing – review & editing.

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