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The Impact of Research-Based Learning and Institutional Support on Student Research Productivity at Madrasah Aliyah Negeri in Jakarta, Indonesia

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ABSTRACT: Student research productivity can be an indicator of the success of the implementation of research-based education in madrasas. However, problems in optimizing research learning, as well as the lack of structural support from madrasas, still affect the level of student involvement in scientific research. Therefore, this study aims to analyze the influence of research learning and madrasah support on student research productivity using the Structural Equation Modeling-Partial Least Squares approach. This study used a mixed-method method with data collection instruments using questionnaires distributed to 490 research-based madrasah students in Jakarta, selected using the cluster random sampling technique. The data collected was then analyzed using SEM-PLS to measure the relationship between research learning, madrasah support, and student research productivity. The validity and reliability of the measuring tool were measured using the Composite Reliability and Average Variance Extracted values. The originality of this research lies in the development of an integrative model to simultaneously analyze the role of research-based learning and madrasah support on student research productivity, especially in the context of madrasah education which has rarely been explored in previous research. The results showed that research learning had the most significant influence on student research productivity ($\beta = 0.255$, $p < 0.001$), while madrasah support had a smaller direct influence ($\beta = 0.125$, $p = 0.006$), but provided an indirect influence through research learning ($\beta = 0.111$, $p < 0.001$). These findings confirm that the synergy between research-based learning and madrasah support is an important factor in increasing the research productivity of madrasah students. The implication of this research is that madrassas need to improve the quality of research learning, provide easier access to research facilities, and strengthen networks with academic and industrial institutions. Understanding of research culture needs to be improved with seminars, journal publications, and research competitions. The study also highlights the importance of technology in improving the effectiveness of research learning.

Keywords: Student research productivity, research learning, madrasahs support, SEM-PLS, research-based education.

I. INTRODUCTION

Risearch-based education has become a fundamental paradigm in developing an adaptive and innovative learning ecosystem. In an increasingly competitive era of globalization, educational institutions are expected to graduate students not only with high academic competence, but also equip them with research skills that enable independent exploration and problem solving [1-4]. Madrasahs, as an integral part of the education system in Indonesia, it faces major challenges in adopting this approach, especially in terms of integrating research into the curriculum. Since 2019, the Ministry of Religious Affairs of the Republic of Indonesia has launched the Research-Based Learning Management Implementation program in Madrasahs with the core mission to instill a research culture among students and improve their competitiveness in the global academic realm [5-7]. However, in its

implementation, the teaching of this program encounters various obstacles that hinder its optimization, at the level of policy, infrastructure, and the readiness of human resources that support it.

More specific problems associated with concrete applications in the madrasa context are limited supporting infrastructure, lack of access to academic literature, and the lack of funds allocated for experiment-based research [7-9]. In addition, the competence of educators in guiding students in systematic and methodological research processes is also a significant problem. This is because most madrasah teachers have no training in research methodology. Therefore, research at the school level is sporadic and unsystematic [10, 11]. Moreover, the weak research culture in madrasas encourages students to focus on the ageist aspects without building research-based analytical and problem-solving skills [12-14]. Therefore, it is felt that concerted action by the government, academia, and other stakeholders is needed to improve the situation and lay the foundation of an encouraging research ecosystem for madrasahs.

In relation to this issue, many academic studies have discussed the importance of research integration in education [11, 15-18]. A number of previous studies have highlighted the importance of research-based learning in improving students' critical thinking, creativity, and problem-solving skills [15, 19, 20]. However, these studies are mostly limited to the context of general education or higher education, while exploration in the context of madrasah education is still minimal and has not explained much about the specific role of madrasah structural support in optimizing research learning models. In addition, although some previous studies [9, 14] indicate the benefits of research learning in madrasas, they have not explicitly addressed the complex interactions between institutional factors such as facility support, teacher training, and access to academic resources with the effectiveness of such research learning. On the other hand, some previous research results still show inconsistencies regarding the extent to which institutional support directly affects student research productivity, so further studies are needed to clarify the relationship in more depth. Therefore, the combination of research learning and structural madrasah support is an area that is still rarely researched, and this research aims to fill this gap by developing an integrative model that is more comprehensive and relevant to the reality of madrasas in Indonesia.

Moreover, a methodological gap remains evident in previous studies focusing on research-based learning and institutional support within madrasah education. Specifically, most existing research tends to employ qualitative or descriptive approaches, offering limited empirical evidence regarding the causal interactions among key variables. Previous studies have largely focused on descriptive analysis without systematically exploring direct and indirect relationships using advanced statistical modeling [7, 9, 14]. To overcome this methodological limitation, this study adopts a rigorous quantitative approach using Structural Equation Modeling–Partial Least Squares (SEM-PLS). This statistical method allows for an explicit examination of both direct and indirect relationships among research-based learning, institutional support, and student research productivity, thereby providing more robust empirical evidence regarding the mechanism of these relationships. Additionally, the use of SEM-PLS addresses potential shortcomings related to multicollinearity and measurement errors frequently overlooked in qualitative or basic quantitative approaches. Therefore, this research offers a significant methodological contribution to the literature by applying a sophisticated analytical technique within the specific context of madrasah education, aiming for greater accuracy and reliability in capturing the complex interactions among variables.

To clarify the scope and ensure conceptual consistency, this study explicitly defines several key terms as follows: Research-based learning in this study refers to an instructional approach that actively engages students in authentic research activities, enabling them to learn through the systematic process of inquiry that includes identifying research questions, collecting and analyzing data, interpreting results, and presenting findings academically. This learning model emphasizes student autonomy, critical thinking, and evidence-based reasoning [15-17]. Institutional madrasah support is defined as the structural and resource-based provisions from madrasah institutions aimed at fostering students' research capabilities. Such support includes infrastructure availability (e.g., research laboratories, digital libraries), accessibility to scholarly resources, supportive educational policies, and teacher competencies in guiding students through rigorous research processes [21-23]. Student research productivity within the context of this research encompasses both the quantity and quality of students' research outputs. It is operationalized as students' capability to produce substantial academic research, characterized by originality, depth of analytical skills, methodological rigor, and effectiveness in scholarly dissemination of research findings [11, 24]. The explicit definitions provided here aim to ensure conceptual clarity and consistency throughout this study.

For this reason, there is still a gap of more specialized research regarding the effectiveness of research-based learning in madrasas. In fact, the research dimension has focused on higher education more than madrasahs,

despite some initial explorations of its practices and challenges at the madrasah level. Therefore, the lack of empirical studies highlighting the interaction between pedagogical, infrastructural, and educational policy factors in supporting research learning in madrasas creates a gap that needs to be filled by this proposed research. Therefore, this study aims to explore the extent to which research learning and madrasah institutional support contribute to improving students' research productivity and develop an integrative model. This research is considered important as a reference for the development of more inclusive and applicable research-based education policies in madrasahs, especially in Indonesia. In particular, this study tries to answer two main research questions, namely: (1) How does research-based learning directly affect student research productivity in madrasas? (2) What is the role of madrasah structural support in directly and indirectly influencing student research productivity through research-based learning?

Specifically, this study aims to examine the direct effect of research-based learning and institutional madrasah support on students' research productivity at Research-Based State Islamic Senior High Schools (Madrasah Aliyah Negeri) in Jakarta, as well as to investigate the indirect influence of institutional support through research-based learning on students' research productivity. Thus, this research aims to clarify the causal relationship between institutional factors and research-based learning methods within the context of madrasahs in urban areas. Based on the literature review and theoretical framework that has been prepared, this study proposes the following three specific hypotheses:

- H1: Research-based learning has a positive and significant effect on the research productivity of madrasah students.
- H2: Madrasah structural support has a positive and significant direct influence on the research productivity of madrasah students.
- H3: Madrasah structural support has a positive and significant indirect influence on the research productivity of madrasah students through research-based learning.

The selection of the research context at Madrasah Aliyah Negeri in Jakarta has high relevance because of Jakarta's strategic position as a national political, economic, and educational center that reflects the dynamics of complex and unique educational challenges and opportunities compared to other regions in Indonesia. As the capital city, Jakarta has the potential for better access to educational resources such as research facilities, digital libraries, and collaborative networks with various higher education institutions and industry. However, madrassas in Jakarta also face significant challenges such as high academic competition between educational institutions, limited integration of research-based curriculum, and psychological pressure on students due to high competition in urban environments. Ironically, despite the greater resource potential, there has not been much in-depth research that specifically explores the interaction between the institutional support of madrassas and the effectiveness of research-based learning in urban contexts such as Jakarta. Therefore, this context offers a valuable opportunity to understand more deeply the critical factors that can increase students' research productivity in this competitive yet resource-rich educational situation.

The findings and recommendations of this study are expected to provide strategic implications for educational management in madrasahs, both in terms of policy, teacher capacity building, and research facilities. By achieving more structured research-based learning and proper institutional support, madrasahs are expected to develop into more progressive, research-based and high-performing educational institutions. In addition, research findings are also expected to encourage a paradigm shift in the madrasah education system. Moreover, the conventional system must be transformed into a research-based and innovation-oriented approach. This is because the integration of research in the madrassa curriculum will not only advance students' academic competencies, but will also equip students with critical, creative and evidence-based thinking to critically address diverse global challenges. Thus, strengthening the madrasah research ecosystem is crucial to support the development of future-oriented education.

II. RELATED WORK

A number of studies on the integration of research-based learning in the education system have been conducted by scholars in both general and religious education contexts. On this basis, several experts corroborate that research-based education is able to improve students' critical thinking skills, creativity, and analytical power so as to improve the quality of academic performance [11, 15, 24]. In addition, research-based learning emphasizes student activities to engage in scientific exploration that leads to increased student conceptual understanding [16, 25]. For this reason, research learning at an early level will result in a high level of academic confidence with more effective problem-solving skills. However, in the study, the author is still at the level of

awareness that the implementation of research-based learning in madrasas still has major challenges, namely infrastructure, access to reliable academic resources and the lack of educators who have academic competence [13, 17]. Therefore, the authors still need to take a more systematic approach when using this learning model in madrasah. One of them is with more in-depth training at the level of educators and more comprehensive regulations.

Research-based learning is fundamentally aligned with the principles of constructivist theory which emphasizes that knowledge is actively constructed by students through direct experience and interaction with the learning environment. In this context, students are not only passive recipients of information, but actively develop understanding through exploration, collaboration, and critical reflection on their research experiences. Previous research using constructivist theory in Islamic education, particularly at the secondary school level such as madrasas, has shown that this approach is effective in encouraging student involvement in the learning process and improving understanding of concepts in depth [7, 8]. Through active participation in formulating research questions, designing methodologies, collecting and analyzing data, and presenting findings independently or in groups, students can internalize research skills more effectively in accordance with constructivist principles. Research-based learning in Islamic education provides opportunities for madrasa students to engage directly in scientific practice, develop critical thinking skills, and strengthen scientific attitudes that are oriented towards evidence discovery and problem solving based on empirical data [10]. Therefore, the application of constructivist theory through research-based learning not only supports student research productivity in the sense of the number of works produced, but also in terms of the quality and depth of analysis produced by students.

Previous studies that have been discussed show that research-based learning can improve learning quality, learning motivation, critical thinking skills, and analytical skills of madrasah students [26-28]. However, previous studies have generally been limited to the direct impact of research-based learning on student research productivity, and few have explored in depth the role of madrasah institutional support, especially the indirect effects through the mediation of research learning. For this reason, research infrastructure, access to academic resources, and institutional learning facilities are important factors that can increase student involvement in research activities [21, 22]. However, these studies have not explicitly examined how madrasah support affects student research productivity if mediated by the quality of research-based learning. It is in this context that this study is important, as it tries to fill the existing research gap by developing and testing the third hypothesis in this study (H3) about the effect of mediation explicitly.

For this reason, constructivism theory fundamentally places students at the center of the learning process, where knowledge is not only passively received, but is actively constructed by students through direct interaction with their learning environment. This is in line with previous research that shows that the constructivist approach has been shown to be effective in increasing student engagement, critical thinking skills, and deeper conceptual understanding, especially in Islamic education or madrasah contexts. For example, found that the application of constructivism in Islamic Religious Education significantly improves the quality of students' critical thinking because this approach directly encourages students to be more active in asking questions, discussing, finding solutions, and daring to express their views openly in real life [29].

In line with these findings, in the study of pedagogy, an inquiry-based constructivist approach in Islamic learning, shows that the constructivist approach has succeeded in improving the Higher Order Thinking Skills (HOTS) of students in madrassas through the empowerment of students' inquiry and independent thinking skills. This confirms that the constructivist approach is able to bridge abstract concepts in religious education to be more concrete and relevant to students' lives, so that the goals of Islamic education are achieved more effectively [26]. Furthermore, the benefits of a constructivist approach in the context of Islamic religious education at the university level, where the application of project-based and collaborative learning has been shown to significantly improve students' learning motivation and academic achievement compared to traditional approaches [27]. Increasing student engagement in constructive learning activities helps their understanding of the teaching material become deeper and more substantial. In addition, constructive simulation as part of constructivist learning gives much better results than conventional lecture methods, so it is recommended that this kind of approach be adopted more widely in the teaching of Islamic studies [28].

Apart from pedagogical aspects, many studies have revealed the implications of institutional support in strengthening madrasah research ecosystems. Schools with adequate research infrastructure have superior academic productivity [21]. Similarly, schools that provide greater access to scientific journals and research labs have higher levels of student engagement in research projects [22]. For this reason, madrasah and higher education collaboration patterns are also considered important to build research capacity for students and educators [30],

[31]. Research shows that a high number of madrasah and higher education partnerships affect students' access to developmental research laboratories and opportunities for intensive mentorship from more experienced teachers [22, 31]. In addition, institutions that have incentive policies for teaching staff, student research mentorship will be able to establish a research-based academic education culture [23]. Thus, strengthening collaboration with universities and madrasah research institutions is one of the key strategies for research-based madrasahs to become madrasahs with progressive alignments.

While some studies have shown research-based learning and institutional support to be beneficial for improving student research productivity, there are no studies specific to madrasas. Furthermore, the related literature is limited to general public educational institutions, and its exploration of madrasah research challenges and opportunities is scarce. Therefore, this study aims to fill the gap in research interests found by exploring the relationship between research learning, institutional support, and madrasah students' research productivity. In addition, this study is intended to provide stronger empirical evidence on the combined effect of these three determinants on strengthening the madrasah research ecosystem. This study will also provide a policy-based approach that can help stakeholders to design more effective strategies in contributing to the enhancement of research capabilities in Secondary Education institutions. In turn, the study is expected to provide better evidence-based policy recommendations in facilitating madrasahs' journey towards becoming more effective and sustainable research-based educational institutions in both general and religious education contexts.

However, previous studies have predominantly focused on higher education contexts and have not explicitly explored the nuanced interactions between pedagogical strategies and institutional factors, particularly within madrasah education. Additionally, earlier studies often neglected specific conditions such as resource availability, institutional support structures, and urban educational challenges faced by madrasahs, thus leaving significant gaps in understanding how these conditions influence student research productivity. Such oversights highlight critical areas that require deeper empirical investigation to provide more comprehensive insights tailored specifically to the madrasah educational environment.

III. MATERIAL AND METHOD

The methodological approach used in this study was systematically designed to answer the research questions and test the research hypotheses. To gain a more real understanding of the research problem, quantitative and qualitative methods were applied in an integrated manner regarding the relationship between research-based learning, institutional support, and madrasah students' research productivity. Therefore, mixed-methods were combined, emphasizing the advantages of quantitative analysis as an objective assessment, supported by broader insights from qualitative analysis [32, 33]. Therefore, this research is not merely exploratory with respect to causal relationships between these variables but rather an exploration of external factors and other qualitative factors that could be significant for policy-making related to research-based learning. In addition, the selection of appropriate analytical techniques, such as Structural Equation Modeling-Partial Least Squares (SEM-PLS) and thematic analysis, ensures that the research results have high validity and reliability, and can be used as a basis for policy recommendations in the development of research-based madrasah [34-36].

1. DATA COLLECTION

The data collection process in this study was systematically designed to ensure accuracy, transparency and replicability. A combination of quantitative and qualitative data collection methods was used, including structured surveys, in-depth interviews, and analysis of relevant academic documents. A total of 490 research-based madrasah students in Jakarta were the survey subjects, selected using cluster random sampling technique [37], to ensure valid representation. The survey instrument was a questionnaire with a 1-4 Likert scale [38], which was validated and tested for reliability using Cronbach's Alpha test (>0.7). The questionnaire consisted of three main constructs, each measured with multiple items adapted from existing validated instruments and modified for the madrasah context. The “research-based learning” construct was measured using 10 items, focusing on students’ active participation in research activities such as problem formulation, literature review, data collection, data analysis, and scientific reporting. The “madrasah institutional support” construct included 8 items, measuring the availability of research infrastructure, access to academic resources, teacher guidance, and administrative support. Lastly, the “student research productivity” construct was measured using 6 items, assessing the number, quality, depth, and academic rigor of students’ research outputs. Each item used a 4-point Likert scale (1 = strongly disagree to 4 = strongly agree). The questionnaire was reviewed by three experts in

educational research and piloted on 50 students from a different madrasah to ensure content clarity and construct validity. Final revisions were made before distribution to the 490 student respondents.

Semi-structured in-depth interviews [32] were conducted with madrasah principals, research-based teaching teachers, research assistant teachers, and students to gain in-depth insights into the institutional support of research-based learning. Additional data were collected from madrasah academic documents, including student research reports, madrasah policies related to research, and education personnel capacity building programs. The data collection process was conducted over three months with quality control measures to ensure the authenticity of the data, including data triangulation between surveys, interviews and academic documents. For this reason, which requires a holistic picture of the links between research-based learning, institutional support, and student research productivity, quantitative methods are also needed for their ability to measure causal relationships and establish patterns of relationships between variables, as qualitative methods are needed for a more in-depth exploration of facets that are contextual and cannot be understood solely from numerical data [32, 37, 39]. Therefore, this study is important because it provides a more comprehensive and evidence-based analysis that is needed to develop policy recommendations that are relevant and applicable to research-based madrasahs.

2. POPULATION AND SAMPLING

The population in this study are all students who take part in research learning in research-based madrasah aliyah in DKI Jakarta Province in 2020. Where the number of research madrasas at the madrasah aliyah level in DKI Jakarta Province is 14 Madrasah Aliyah located in five cities in DKI Jakarta Province in 2020. The sample selection technique is cluster random sampling [37], by dividing the Jakarta area into five city clusters. The sample size in this study as many as 490 students of Madrasah Aliyah Negeri based on research in Jakarta was selected by cluster random sampling technique. This technique is used with the consideration that the student population is geographically spread across the five administrative areas of the city of Jakarta (South Jakarta, North Jakarta, West Jakarta, East Jakarta, and Central Jakarta). Cluster random sampling allows for representative sampling by randomly selecting madrasas from each region. The sample size of 490 students is considered adequate for the analysis of Structural Equation Modeling–Partial Least Squares (SEM-PLS) because the number has met the minimum standard recommended in the SEM methodological literature, which is at least five times the number of research variable indicators (rule of thumb). Considering that the number of indicators in this study is 20 indicators, the minimum recommended sample size is 100 respondents (5 times the number of indicators). Thus, the number of samples of 490 students far exceeded the minimum provision, thus ensuring the accuracy, stability of parameter estimation, and validity of the results of the SEM-PLS analysis in this study. Table 1 is a list of selected madrasahs and the number of samples used in the study.

Table 1. Research population and sample.

No	Administrative Cities	Selected Madrasah	Total
1	Jakarta Selatan	MAN 13 Jakarta Selatan	98
2	Jakarta Utara	MAN 21 Jakarta Utara	95
3	Jakarta Barat	MAN 12 Jakarta Barat	97
4	Jakarta Timur	MAN 20 Jakarta Timur	102
5	Jakarta Pusat	MAN 3 Jakarta Pusat	98
	Total		490

The samples in this study were all students in grades X, XI, and XII who participated in research learning. After data cleaning, the total sample size was 490. The population of this study is all students in grades X, XI, and XII who participated in research learning at research-based madrasah aliyah in Jakarta, Indonesia.

3. INSTRUMENT VALIDATION AND RELIABILITY TESTING

Before the main data collection phase, a rigorous validation process was conducted to ensure the robustness, validity, and reliability of the research instrument. Initially, the instruments were developed based on an extensive review of relevant literature, theories, and similar validated instruments from previous empirical studies. Subsequently, to ascertain content validity, the instrument items were reviewed and evaluated by three experts in educational measurement and evaluation to ensure clarity, relevance, and appropriateness within the

madrasah education context. Following content validation, the instrument underwent a pilot study involving 50 students with similar characteristics to the main sample, but who were not included in the primary dataset. Construct validity was then assessed through Confirmatory Factor Analysis (CFA). This approach was specifically selected due to its strength in validating the theoretical structure and dimensionality of the constructs. The CFA was conducted using structural equation modeling software (SmartPLS version 3.3.9) to evaluate factor loadings of individual items. Factor loadings were scrutinized carefully, and items achieving loadings below the generally accepted threshold of 0.60 were excluded or revised to enhance measurement precision and reduce measurement error. Through this iterative process, the finalized instrument consisted only of items with factor loadings ranging from 0.68 to 0.92, thus exceeding the recommended criterion.

Reliability analysis was conducted subsequently to evaluate the internal consistency of each construct, measured through Cronbach's Alpha and Composite Reliability (CR). Cronbach's Alpha values obtained from the final instrument demonstrated excellent internal consistency: 0.942 for research-based learning, 0.809 for madrasah institutional support, and 0.890 for student research productivity, all surpassing the recommended minimum of 0.70. Additionally, Composite Reliability values were consistent with Cronbach's Alpha, further confirming the high reliability of the measurement constructs. Finally, discriminant validity was examined by evaluating the Average Variance Extracted (AVE) values, ensuring each construct distinctly represented unique conceptual aspects without significant overlap with other constructs. All AVE values exceeded the recommended threshold of 0.50, confirming satisfactory discriminant validity. Consequently, this comprehensive validation process ensured that the measurement instrument was robust, valid, and reliable, effectively supporting the Structural Equation Modeling-Partial Least Squares (SEM-PLS) analysis used in this study.

4. PROFILE OF RESPONDENT CHARACTERISTICS

The presentation of respondents' backgrounds in this research is explained by collecting data on respondents' characteristics based on madrasa origin, gender, and grade level. The profile of the respondents' characteristics is needed as descriptive information which distributes the number of students who participated in the research and the potential involvement of these respondents in research activities in madrasah. The number of respondents in this study was 490 MA students from madrasahs in the Jakarta area. The respondents were from MAN 13 South Jakarta, and MAN 3 Central Jakarta, while the number was more female than male. Third, from several existing grade levels, most of the respondents used the XI grade level which in percentage has a higher level of involvement than other classes. For this, an overview of the respondents' characteristic profile is shown in table 2.

Table 2. Respondent characteristic profile.

Variable	Description	Frecuency	%
Name of Madrasah	MAN 12 Jakarta Barat	93	18.98%
	MAN 13 Jakarta Selatan	107	21.84%
	MAN 20 Jakarta Timur	88	17.96%
	MAN 21 Jakarta Utara	97	19.80%
	MAN 3 Jakarta Pusat	105	21.43%
Gender	Man	151	30.82%
	Women	339	69.18%
Level Class	X	176	35.92%
	XI	187	38.16%
	XII	127	25.92%

This distribution suggests that the research involved more female students and those in grade XI, who are likely to have higher levels of engagement in research activities in their madrasahs. This can be taken into consideration in designing research programs in madrasahs to include more students from different grade levels and genders in a more balanced manner.

5. RESEARCH DESIGN

This study uses a quantitative research design with an explanatory research approach [37, 39], which aims to analyze the relationship between research-based learning variables, institutional support, and student research productivity. This approach was chosen for its ability to provide identification of cause-and-effect relationships and hypothesis testing through statistical parameters. The research model was tested using the Structural Equation Modeling-Partial Least Squares method which can test direct and indirect relationships between variables with a high degree of accuracy [34-36]. In the SEM-PLS analysis conducted in this study, each latent construct was measured using multiple reflective indicators, which were developed based on theoretical relevance and empirical validation from previous research. The "Research-Based Learning (RBL)" construct was measured using 10 indicators, including: (RBL1) identifying research problems, (RBL2) formulating research questions, (RBL3) conducting literature reviews, (RBL4) designing data collection instruments, (RBL5) gathering data, (RBL6) analyzing data, (RBL7) drawing conclusions, (RBL8) writing research reports, (RBL9) presenting findings, and (RBL10) reflecting on research experience. The "Madrasah Institutional Support (MIS)" construct consisted of 8 indicators, such as: (MIS1) availability of research infrastructure, (MIS2) access to digital libraries and journals, (MIS3) research funding support, (MIS4) availability of trained supervisors, (MIS5) administrative support, (MIS6) scheduling flexibility for research, (MIS7) availability of seminars/workshops, and (MIS8) encouragement of collaboration with higher education. Lastly, the "Student Research Productivity (SRP)" construct was measured using 6 indicators, including: (SRP1) number of research projects completed, (SRP2) frequency of participation in research competitions, (SRP3) publication of student research, (SRP4) depth of analysis in student work, (SRP5) originality and innovation in research topics, and (SRP6) ability to present and defend research orally. These indicators were analyzed through Confirmatory Factor Analysis (CFA) using SmartPLS 3.3.9 to assess their factor loadings and establish construct validity. Only indicators with loading values above 0.60 were retained in the final model to ensure measurement precision and theoretical relevance. Furthermore, a qualitative approach was used to better understand the dynamics of research-based learning implementation in madrasah by conducting in-depth interviews [40].

The choice of SEM-PLS method in this study also makes sense on its advantages when handling models with many latent variables. SEM-PLS allows the author to estimate causal relationships between variables simultaneously. This model is also a good choice because it is more flexible for cases when the data is not normally distributed. The advantages of SEM-PLS include the ability to offer an optimal solution despite "the much higher uncertainty associated with the relationships between the estimated variables" [35, 36]. One of these is the important consideration that the authors only had thirteen valid questionnaires. SEM-PLS can more efficiently analyze the relationship between exogenous and endogenous variables, thus providing more specific explanatory results. For this, the analysis of Structural Equation Modeling-Partial Least Squares (SEM-PLS) in this study was carried out using SmartPLS software version 3.3.9. SmartPLS was chosen for its ability to manage complex SEM models, including in situations where data does not meet normal distribution assumptions. To ensure the statistical validity of the results of parameter estimation in the model, the bootstrapping procedure was applied with 5,000 resampling, following the general recommendations applicable in the SEM literature. This bootstrapping process allows for the assessment of the statistical significance of the relationship paths between variables in the model. In addition, although this study did not explicitly test the effects of moderation or interactions between variables, further analysis considering the moderation effects of additional variables such as students' socioeconomic background or access to external resources may be considered for future studies, thus enriching understanding of the specific conditions that affect the effectiveness of research-based learning and madrasah support on research productivity student.

5.1 Quantitative Research Design

Surveys are the primary technique used in quantitative data collection. Digital questionnaires are administered to randomly selected respondents and developed based on a standardized scale. The data obtained in this way is then analyzed using descriptive and inferential analysis [32]. This also includes regression tests and path analysis in SEM-PLS. Previously, statistical assumption tests such as normality, multicollinearity, and heteroscedasticity were conducted to ensure the validity and reliability of the results.

Another approach chosen is quantitative because of the objective measurement of the relationship between variables and empirical evidence that can be statistically tested. Thus, this research will be able to identify patterns of the relationship and impact of student outcome-based learning on student productivity in madrasah and schools

more accurately. Furthermore, this approach will provide related results that may be used in generalizations and policy implications of madrasahs.

In this study, there are a number of potential variables that are not explicitly included in the model, but have the possibility of affecting the research productivity of madrasah students indirectly. These variables include students' socioeconomic background, access to learning resources outside the madrasah environment such as internet facilities at home, parental support, and intrinsic motivation of students that are not directly measured in this study. These variables can contribute to variations in student research productivity, which means that the results of the SEM-PLS analysis in this study need to be interpreted by considering the possible impact of these disruptive variables. Further research is recommended to explicitly include these variables in the analysis, in order to obtain a more comprehensive picture of the factors that affect the research productivity of madrasah students.

5.2 Qualitative Research Design

To generate a deeper perspective on the constraints and opportunities of PLBR implementation in madrasahs, qualitative research was also conducted. Interviews were conducted using a semi-structured based method [32, 37], and the initial questions asked were in line with the preliminary findings found from the quantitative data. The interview data were analyzed using thematic analysis technique, where the researcher tried to identify thematic patterns in the dataset relevant to the research questions. The resulting information will be used to cross-reference the quantitative data, ensuring the accuracy of the findings while providing a broader perspective to research-based madrasah policymaking.

In many ways, the qualitative approach replaces the quantitative analysis with more technical insights into the specific contextual factors that influence the implementation of research-based learning. In addition, with respect to another arc of reasoning, spot interviews allowed for the determination of factors learned from the internal dynamics of the madrasah that could not be assessed quantitatively. These include madrasah educators' perceptions of the effectiveness of research-based learning programs and structural issues with the use of community foundations in fostering a culture of research-based learning in madrasahs. Therefore, the quantitative and quantitative approach of the dataset studied in this project ensures that the characteristics obtained by the privacy have a statistical threshold. In other words, the privacy compiled and obtained in the development is not only statistically valuable, but also practical for policy developers in creating research-based avenues for madrasas in the future.

In order to ensure that the measurement and structural models meet acceptable standards of validity and reliability, additional tests were performed. First, to examine potential multicollinearity issues among predictor variables in the structural model, Variance Inflation Factor (VIF) values were calculated. All VIF values were below 3.0, which is well under the commonly accepted threshold of 5.0, indicating no significant multicollinearity problem. Second, the overall model fit was assessed using Standardized Root Mean Square Residual (SRMR), which is a common goodness-of-fit indicator in SEM-PLS. The SRMR value obtained was 0.064, which falls below the threshold of 0.08, indicating a good model fit. These results suggest that the model adequately represents the data and the hypothesized relationships among constructs are statistically acceptable. Furthermore, the R^2 (coefficient of determination) values for endogenous constructs were also examined, showing values of 0.622 for research productivity, 0.547 for research-based learning, and 0.431 for institutional support, indicating substantial explanatory power of the model. These findings reinforce the robustness and predictive relevance of the structural model used in this study.

Although SEM-PLS is a powerful analytical method for estimating complex causal relationships, it has several inherent limitations that should be acknowledged. First, SEM-PLS does not assume normal distribution of data, which makes it suitable for small to medium samples, but also limits the use of parametric tests for certain estimations. Second, SEM-PLS emphasizes predictive accuracy over model fit, which may result in less emphasis on overall goodness-of-fit compared to covariance-based SEM methods. Third, SEM-PLS assumes linear relationships among variables, which may oversimplify the complexity of certain interactions that are potentially nonlinear or influenced by interaction effects. Finally, because SEM-PLS is primarily variance-based, it is more sensitive to measurement errors and multicollinearity if not controlled properly. Therefore, while SEM-PLS is appropriate for exploratory models with latent constructs and limited distribution assumptions, the results should be interpreted with caution and ideally complemented with alternative or follow-up analyses in future research.

IV. DATA ANALYSIS

This chapter presents data analysis as an important part of the study, where several methods and techniques were used to interpret and organize the data collected. The data analysis aimed to identify patterns, relationships, and trends related to research learning, madrasa support, and student research productivity. The approaches used in this analysis include quantitative methods and inferential statistics, including Structural Equation modeling - Partial Least Squares analysis to measure the relationships between the research variables. Validity and reliability tests of the research instruments are also conducted to ensure that the data used is highly reliable. In addition, the analysis will highlight the duration and form of research learning implemented in madrasahs which will provide insight into the efficiency of the ongoing program. The data presented in the table and the interpretation of the findings will help to understand the role performed in improving student productivity, as well as the support madrasah can facilitate the process more optimally.

1. DURATION AND FORM OF RESEARCH LEARNING

Research learning is an important element in developing students' academic skills in madrasah. Since the implementation of the 2020 research-based madrasah program, students have been exposed to various models and durations of research learning. For this reason, this analysis evaluates the pattern of student participation as well as the effectiveness of the methods applied. The study also identifies factors that influence student participation in research. The results are expected to lead to an improved research-based curriculum that is open-source and adaptive. At the same time, integrated research learning aims to improve students' academic competitiveness and foster a research culture early on. With excellent research skills, students are able to think critically, analytically, and solution-oriented academically and in real life. Therefore, innovative teaching methods are needed to make research more interesting and applicable. For this reason, the length and form of research learning in this study are important to obtain effective information on the academic process that has been carried out. Details on the length and form of research learning are shown in Tables 3 and 4.

Table 3. Length of research learning.

Length of Learning	Frequency	%
< 1 semester	216	44.08%
1 semester	52	10.61%
2 semester	110	22.45%
> 2 semester	112	22.86%

Table 4. Forms of research learning.

Forms of Learning	Frequency	%
Elective subjects	37	7.55%
Competition Coaching	40	8.16%
Extracurricular	141	28.78%
Local Payload	272	55.51%

The data in tables 3 and 4 show that almost half of the students, 44.08%, have only gone through less than one semester of research learning, and only 22.86% of students have repeatedly gone through more than two semesters of research learning. This suggests that for most students, the research program remains in the introductory phase of the program and needs additional, more intensive learning strategies to ensure depth of understanding. In terms of formation, the majority of students, 55.51%, go through research learning in a local content format, and extracurricular or extracurricular learning methods are the third most used, 28.78%. This means that in certain contexts, a curriculum-centered approach is embraced in terms of learning methods and instruments rather than flexible learning methods, such as competition mentoring, which only 8.16% of students participated in. The fact that only 7.55% of students chose elective subjects suggests that the selection and decision to study research. Overall,

this data shows that madrasas have integrated research into their curriculum. Therefore, more strategic policy development is needed to increase students' interest in research in madrasahs.

1.1 Results of Analysis SEM-PLS

To evaluate the correlation between research learning, madrasah support, and research productivity of research students, Structural Equation Modeling-Partial Least Squares (SEM-PLS) was used. This approach allows for simultaneous analysis of measurement and structural models. As a result, it is possible to examine the validity and reliability of indicators at the measurement stage, as well as the causality of relationships between variables in the structural model. Therefore, the relationships between the main referring factors can be deciphered in greater depth, and their role becomes a more accurate and detailed understanding of how madrasahs can improve the quality of research learning. In addition, with micro sample coverage and complex models, SEM-PLS is more advanced than other alternative methods. Therefore, the information from this SEM-PLS analysis is expected to help policy makers to come up with more effective development strategies, as well as support student engagement in research.

1.2 Measurement Model (Validity and Reliability)

To ensure the accuracy of the data, validity and reliability tests were carried out on the research instruments. Validity testing is done by looking at the factor loading value which shows the extent to which the indicator is able to measure the variable in question. Reliability testing is done by looking at the Cronbach's Alpha and Composite Reliability values, as shown in Table 5.

Table 5. Measurement model reliability test results.

Variabel	Cronbach's Alpha	Composite Reliability	AVE
Learning	0,942	0,949	0,522
Support	0,809	0,863	0,515
Productivity	0,890	0,909	0,502

From Table 5, as can be seen, the results of the validity and reliability tests show that all variables meet these criteria. All Composite Reliability values are above 0.7. From these results, it can be said that the indicators in each variable have fairly good consistency. In addition, the high Cronbach's Alpha value indicates that the respective constructs have strong internal reliability. In addition, the Average Variance Extracted value is above 0.5, this means that the constructs have sufficient convergent validity. Thus, the indicators in one variable are able to explain the variable sufficiently. Therefore, the research instrument can be said to be valid and reliable for measuring these variables. To ensure the robustness and internal consistency of the instrument, reliability testing is performed using Cronbach's Alpha value. The Cronbach's Alpha values obtained for each construct were as follows: research-based learning (α = 0.942), madrasah support (α = 0.809), and student research productivity (α = 0.890). According to the SEM methodology literature, Cronbach's Alpha value above 0.70 indicates an excellent level of instrument reliability. Therefore, the results of the analysis show that the instruments used in this study have high reliability, thus ensuring that the findings produced are strong and trustworthy.

Table 6. Reliability analysis (cronbach's alpha).

Constructs	**Cronbach's Alpha**	**Reliability Interpretation**
Research-based Learning	0.942	Excellent
Madrasah Institutional Support	0.809	Good
Student Research Productivity	0.890	Excellent

The Cronbach's Alpha coefficients for all constructs indicate high reliability, exceeding the recommended threshold of 0.70. Specifically, the reliability values for Research-based Learning (α = 0.942) and Student Research Productivity (α = 0.890) indicate excellent internal consistency, while Madrasah Institutional Support (α = 0.809) demonstrates good internal consistency. These findings confirm that the measurement instruments employed in this study are robust, ensuring confidence in the validity and reliability of the results obtained from the SEM-PLS

analysis. Consequently, the relationships among the variables presented in this research are considered credible and statistically dependable.

1.3 Structural Model Analysis

Once validity and reliability are confirmed, structural model analysis can be applied to test the relationships between the variables potentially present in the study. The next technique is to use Structural Equation Modeling as a testing method, while using the Partial Least Squares approach. The model can be tested by examining the ratio of the path coefficient to the square root of the R^2 and the percentage t-statistic value, which will be obtained from swapping. A robust test of the model, even the extent to which the inductive design can explain the relationships between latent variables, can be measured through the Goodness-of-Fit test. The test results show strong statistical significance of the relationships between variables, with the way-point-only indicators able to meet the recommended thresholds from the literature study in the research methodology, as shown in Table 7 and Table 8.

Table 7. Path coefficients, standard errors, t-statistics, p-values, and 95% confidence intervals (sem-pls results).

Path Relationship	Path Coefficient (β)	Standard Error (SE)	T-Statistic	P-Value	95% Confidence Interval
Research Learning → Research Productivity	0.255	0.045	5.624	0.000	[0.166, 0.344]
Madrasah Support → Research Productivity	0.125	0.045	2.762	0.006	[0.036, 0.214]
Madrasah Support → Research Learning	0.437	0.043	10.154	0.000	[0.353, 0.522]

Table 8. Indirect effects and total effects.

Indirect Path Relationship	Indirect Effect (β)	Standard Error (SE)	T-Statistic	P-Value	95% Confidence Interval
Madrasah Support → Learning → Productivity	0.111	0.023	4.864	0.000	[0.066, 0.156]
Total Effect (Madrasah Support → Productivity)	0.236	0.048	4.917	0.000	[0.142, 0.330]

The path analysis results presented above include path coefficients, standard errors (SE), t-statistics, p-values, and 95% confidence intervals (CIs). The direct relationship between Research Learning and Student Research Productivity is statistically significant with $\beta = 0.255$ (SE = 0.045, 95% CI [0.166, 0.344]), indicating a robust positive influence. Similarly, Madrasah Institutional Support has a smaller but statistically significant direct effect on Student Research Productivity ($\beta = 0.125$; SE = 0.045, 95% CI [0.036, 0.214]). Notably, Madrasah Institutional Support strongly predicts Research Learning ($\beta = 0.437$; SE = 0.043, 95% CI [0.353, 0.522]). Moreover, the indirect effect analysis reveals that Madrasah Institutional Support significantly affects Research Productivity through Research Learning ($\beta = 0.111$; SE = 0.023, 95% CI [0.066, 0.156]), underscoring the importance of institutional support in enhancing research learning effectiveness. All confidence intervals exclude zero, reinforcing the statistical robustness of these findings.

For this, the results of the SEM-PLS analysis show that the first hypothesis (H1) that research-based learning has a positive influence on student research productivity is significantly proven ($\beta = 0.255$, $p < 0.001$). These findings are consistent with constructivist theories and the results of previous studies (e.g. Morales-Verdejo, 2025; Usman et al., 2024), which states that students' active involvement in the research process will improve analytical skills, critical thinking, and produce more quality research work.

For the second hypothesis (H2), that the institutional support of madrassas directly increases students' research productivity, significant evidence was found but with a smaller path coefficient ($\beta = 0.125$, $p = 0.006$). Although this relationship is in line with the results of expert research [21, 22], that institutional support helps increase student engagement in research activities, this relatively low coefficient suggests that there are other factors outside of institutional support that may have a stronger influence on student productivity. This is an interesting finding because some previous literature suggests that institutional factors tend to have a major impact on students' academic productivity [31]. This difference may be due to special conditions or variations in the characteristics of the madrasah environment studied in this study.

The third hypothesis (H3), which states that madrasah support indirectly affects student research productivity through improving the quality of research-based learning, is strongly supported by the results of the analysis ($\beta = 0.111$, $p < 0.001$). These findings affirm the importance of the supporting function of madrasas as a factor that

facilitates and strengthens the quality of research-based learning, that institutional facilities and teacher assistance are very important in creating a conducive environment for students' research learning [23].

Overall, the results of this study are generally in line with the existing literature, but also show some findings that are not entirely in line with initial expectations. For example, the low direct influence of madrasah support on student productivity is somewhat different from some previous studies that showed a greater effect. This difference indicates that the specific context of madrassas in Jakarta has characteristics that need to be studied further, including the possible role of additional variables such as student motivation, access to external resources, and socioeconomic factors that have not been included in this research model.

1.4 Indirect Effects

In order to better understand how research learning mediates the relationship between madrasah support and research productivity, an indirect effect analysis using the Path Analysis method was also conducted. The aim is to determine the extent to which research learning is able to bridge the effect of madrasah support on research productivity. This is important because madrasah support has a lasting effect on research productivity, which can be achieved directly and indirectly, which is based on how to improve research learning. If research learning is indicated to have a significant relationship with research productivity, then madrasah support is consequent to research productivity based on research learning capacity first. Table 9 shows the results of the analysis including the Indirect Effect, T-Statistic, P-Value, and Total Effect values.

Table 9. Uji hipotesis path coefficient (indirect effect & total effect).

Relationship	Indirect Effect (β)	T-Statistic	P-Value	Total Effect (β)
Support → Learning → Productivity	0,111	4,864	0,000	0,236

These results show that madrasah support has an indirect influence on research productivity through research learning with a path coefficient of 0.111 ($p < 0.001$). The total effect of madrasah support on research productivity is 0.236, which means that most of the influence of madrasah support on research productivity is mediated by research learning. In this case, the mediation analysis confirms that research-based learning serves as a significant pathway through which the institutional support of madrasas affects student research productivity. This shows that madrasah support alone is not enough unless it is transformed into an actionable learning experience. The effectiveness of this mediation can be attributed to the cognitive engagement and active behaviors that students engage in during research-based learning. Unlike structural support, research learning directly shapes students' inquiry skills, perseverance, and confidence. In addition, the presence of teacher mentoring and peer collaboration in research projects strengthens student discipline, feedback exchange, and deeper ownership of learning factors that are not always embedded in institutional policy alone. Thus, the role of research-based learning mediation represents an internalization mechanism, where support is operationalized into competencies and tangible outcomes through immersive learning. This explains why the indirect effects in this model are statistically powerful and educationally meaningful.

The role of research-based learning as a mediator is rooted in its function as a translational process that transforms structural support into tangible student outcomes. Madrasah institutional support, such as facilities, resources, and administrative backing, provides the external scaffolding, but without a pedagogical mechanism to internalize that support, its effect remains limited. Research-based learning fills this gap by offering a pedagogically rich environment where students can meaningfully apply institutional resources in authentic academic contexts. Moreover, research-based learning enhances the quality of learning experiences by promoting inquiry-based engagement, critical thinking, and reflective practice all of which contribute directly to students' academic productivity. Beyond pedagogy, the institutional culture of the madrasah also plays a moderating role: in madrasahs where research is culturally valued, students are more likely to view inquiry as a core academic practice rather than an optional activity. This alignment between institutional values and learning design reinforces the mediation mechanism. In this sense, research-based learning becomes not just a curriculum strategy, but a cultural bridge that activates the potential of institutional support through student-centered, inquiry-driven education.

2. STUDENT RESEARCH PRODUCTIVITY

Students' research productivity reflects their level of success in producing scientific work during the research-based learning process. Indicators of research productivity include aspects such as research proposal preparation, scientific report writing, involvement in research teams, and participation in research seminars and competitions. For this, the characteristics that can be used to measure student research productivity. The results show students' research productivity as shown in Table 10.

Table 10. Student research productivity.

Indikator	Rata-rata (%)	Factor Loading
Create a research proposal	44.23%	0.793
Writing a research report	45.41%	0.800
Writing scientific papers	38.57%	0.639
Engage in research teams	42.96%	0.780
Presenting research results	33.72%	0.673
Participating in a seminar on research results	31.48%	0.591

Writing a research report (45.41%) and creating a research proposal (44.23%) were the two main research activities based on the data obtained. This indicates that first-year research mostly succeeds well in students' initial endeavors. The highest factor loadings are 0.800 and 0.793, respectively, which means that they are the most significant contributors of students' research productivity. On the other hand, participation in research seminars is 31.48% and presentation of research results is 33.72%. The lower factor loading implies that students are still far from scientific forums. This means that only a few are able to participate in forums for a broader participation experience. Another indicator is involvement in research teams 42.96%. The factor loading of 0.780 indicates that the actual involvement is good but should be further improved. This is because being involved in a research team provides greater opportunities to gain new skills and perspectives in research and experimentation, so it should be strengthened.

3. STRUCTURAL MODELLING

Structural modeling in this study uses the Structural Equation Modeling - Partial Least Squares (SEM-PLS) approach to examine the relationship between research learning, madrasah support, and student research productivity. This model helps identify the direct and indirect effects of the independent variables on the dependent variable.

3.1 Analisis Direct Effect

The results of the direct effect analysis show the direct relationship between the variables in the study. This direct effect analysis shows the extent to which each variable influences each other directly and does not intervene with other variables. This direct effect analysis is important to know how much the direct relationship of madrasah support and research learning to the productivity of the two variables on students. Thus, it can be known which variable is influential and dominant. Table 11, following the results of testing the relationship between variables:

Table 11. Uji hipotesis path coefficient (direct effect).

Relationship Between Variabel	Path Coefficient (β)	T-Statistic	P-Value
Learning → Productivity	0.255	5.624	0.000
Support → Productivity	0.125	2.762	0.006
Support → Learning	0.437	10.154	0.000

The results also support this fact: the effect of research learning on students' research productivity is significant ($\beta = 0.255$, $p < 0.001$). In other words, the higher the quality of research learning students receive, the more productive they will be in conducting research and creating scientific papers. Furthermore, the direct effect of

multilevel madrasah support on students' research productivity was also significant (β = 0.125, p = 0.006); however, this effect was lower than that of research learning. This can be explained by the assumption that while direct learning strongly supports research productivity, other relevant factors also influence students' abilities. Thus, having a supportive environment still helps students be much more active and productive. Furthermore, madrasah support has a very large impact on the quality of direct research learning β = 0.437, p < 0.001). Therefore, the greater the madrasa support students receive, the better their research learning. In this case, madrassa support not only has a direct effect on research productivity but is also one of the key elements that lead to quality learning. The latter is a key factor in a stronger research culture, and the fact that madrassa support has a significant impact proves that this factor is an area that needs to be improved in the most extreme cases.

3.2 Analisis Indirect Effect (Mediation Effect)

This work should test whether research learning acts as a mediator in the relationship between madrassa support and student research productivity. This mediation effect also has significant implications in this analysis. We believe that madrasah support may increase research productivity directly, or this effect may be stronger with an increase in the quality of research learning. Consequently, the results of the analysis can give us insights into which approaches can be more effective for improving student productivity. The test results for the mediation effect are based on the hypothesis test of the Path Coefficient of the.

Table 12. Uji hipotesis path coefficient (indirect effect & total effect).

Relationship	Indirect Effect (β)	T-Statistic	P-Value	Total Effect (β)
Support → Learning → Productivity	0.111	4.864	0.000	0.236

The study found that: madrasah support has an indirect effect on research productivity, specifically through research learning with a coefficient β = 0.111; p < 0.001. It was found that research learning plays an important role in enhancing the impact of madrasah support on students' research productivity. This means that while the direct support to research productivity in madrasas is influential, which means that the focus on internalization risk is increasing, the influence on productivity is stronger when channeled through better research learning. In addition, the total effect of madrasah support on research productivity is β = 0.236, which is also dramatically higher than the main hypothesis. Thus, it can be concluded that efforts to improve student research productivity should indeed often be focused on research learning itself. In other words, madrasah support alone will be most useful when coupled with integrated learning that makes them stronger in this learning. Therefore, madrasas should be more aggressive in providing research facilities, supporting students' research schemes, and ensuring their guidance.

3.3 Implications and Optimization of Structural Models

In research-based learning, the structural model influences the effectiveness of students' analytical and critical thinking skills. The prototype structural model needs to demonstrate an equitable distribution of institutional support, research training and academic collaboration, all of which will enhance students' research capabilities. However, many schools struggle with implementing this structure due to uneven support systems, inadequate (academic) training and gaps in academic networks. A better structured model that integrates these elements of research-based learning is represented in Figure 1 below

This structural model positively centralizes research training, institutional support, and collaboration in academia, creating synergies that balance research development for students. At the core of this is, Structural Model Optimization, which is a customized basic key area that creates synergy for a balanced and structured flow in research excellence. To this end, in the skill development process, it all starts with Research Methods Training to develop analytical skills, followed by Proposal & Report Writing, strengthening their ability to structure research details into a written format. User access to higher academic standards is encouraged through the initiatives mentioned below: Academic Connections, University Collaborations, Higher Education Scientific Seminars & Workshops, which aim to increase research exposure. On the other hand, Institutional Support guarantees a solid research background, while Research Labs offer essential facilities and Research Mentees provide professional advice. As such, it reflects the symbiotic nature of the language, the complexity between these pillars, which are nothing but a continuation of learning, mentoring, and academics, not built in isolation of each other to build research excellence. These structured pathways, within the institution, enable the utilization and leveraging of institutional resources for student success and align incentives for academic activities across the institution.

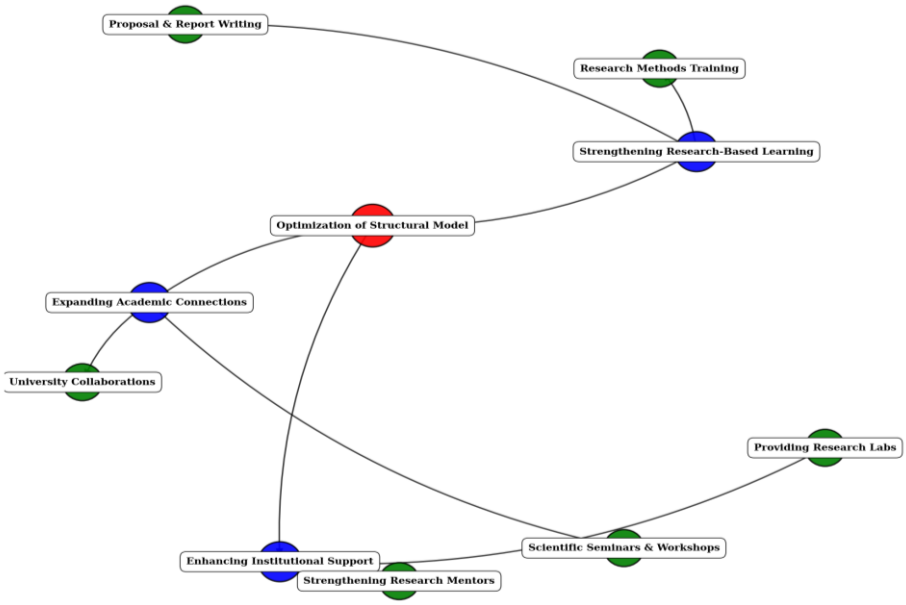
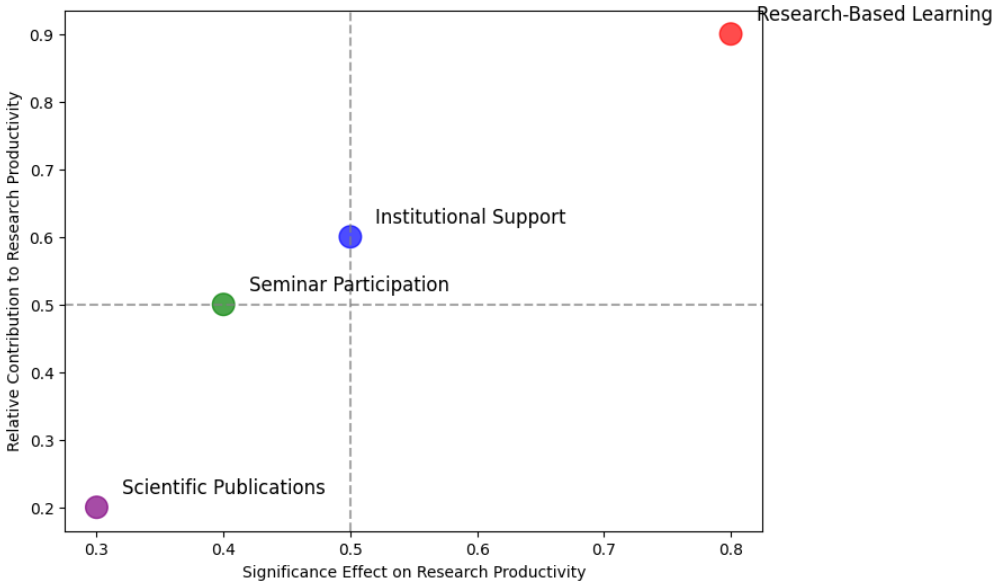


FIGURE 1. Implications and optimization of structural models.

V. DISCUSSION

Based on the results of this study, it was found that research learning influenced students' research productivity most significantly, with madrasah support helping to perform the role of supporting factors that strengthen students' research skills. This finding is in line with previous research on the importance of a positive learning environment in developing research skills at the secondary school level [7, 9, 41]. Quantitatively, madrasah support has little direct impact on research productivity, but indirectly has a greater impact through its role in improving the quality of research learning. Thus, this study confirms the constructivist learning theory model where direct experience in research learning is stronger than 'indirect' external factors of research learning outcomes [11, 18, 42, 43], which are not directly related to student activity. To further analyze the relationship between the variables in this study, a quadrant of research factor performance was created by considering the significance of the effect and the relative contribution to students' research productivity.



PICTURE 2. Quadran performance of research factors.

The quadrant analysis (Figure 2) shows a structured hierarchy of appropriate practices that enhance student research productivity, with Research-Based Learning being the strongest driving influence. In the fourth quadrant, Research-Based Learning has high importance and high relative contribution as a key driver for research engagement. The negative effects of passive learning may have contributed to this result, as constructivist learning theory suggests that the integration of experiential research helps develop deeper levels of analytical reasoning and methodology, emphasizing skills for research productivity [44], [45], [46]. As empirically placed, this variable emphasizes that institutions need to ensure structured research training, proposal development and methodological rigor as the most important elements of student research development. In contrast, institutional support: although useful, sits somewhere in the middle of the quadrant, suggesting that its lack is only a secondary obstacle to research productivity. However, its role as an indirect enabler is quite significant, mostly through the provision of research facilities, mentorship programs, and access to academic resources. To that end, these findings highlight the importance of re-examining how to increase the impact of research-based learning. While institutional support structures are not sufficient to generate productive research in the long run, they do ensure sustainability and a strong long-term quality of engagement when paired with a student-centered research training environment.

At the same time, Seminar Participation presents a moderate significance and low relative contribution to student research outcomes. While any academic seminar or workshop does offer exposure to scholarly discourse, networking opportunities, and peer learning, it is not its primary motive force for research productivity, which suggests that institutions should incentivize seminar participation as an additional mechanism through which methodological training is reinforced as opposed to an independent driver of research success. Participation in academic seminars, especially over a long period of time, is associated with gradual adjustment and integration into academia as well as advancement in research skills, although its direct impact on research activity and outcomes is quite limited in the short term. The lowest significance and contribution of Scientific Publications in the lower left quadrant reflects the maturity gap in student researchers' capabilities. While it may be the case that publications are the perfect measure of academic productivity, students-especially at the secondary level of education-are not yet at the stage where research output is a major factor of productivity. To that end, this study suggests publications should be seen as a long-term research outcome [12], [17], [47], rather than a short-term expectation, where emphasis needs to be placed on developing research competencies through hands-on educational training and structured mentorship first..

This quadrant analysis is further substantiated by the research findings, that research-embedded learning has been the single most decisive predictor of research performance, aligning with the long-established and widely accepted philosophy of content construction, which has long advocated the direct mention of learning research rather than passively absorbing externalities [48], [49], [50], [51]. Therefore, temporary recognition enables research-oriented outputs and feedback loops from departmental colloquia and seminar attendance. Such outputs are an important feature of managing the phenomenological perception system of early stage researchers and their faculty mentors, both of which need to be integrated into the curriculum and pedagogy at the formal level (closer research rotation stage in training). Such information will help institutions prioritize research-based methods of student learning, allowing them to experience hands-on training, methodological knowledge, and institutional support through effective resourcing to ensure long-term academic success.

VI. CONCLUSION

The results of this study show that research learning has the most significant influence on student research productivity, while madrasah support plays an important role as a supporting factor that strengthens the effectiveness of research learning. SEM-PLS analysis shows that madrasah support has a greater indirect effect than direct effect on student research productivity, meaning that madrasah support is more effective when combined with a good research learning system. Factors such as involvement in seminars, participation in research teams, and scientific publications still have room for further development to optimize student research productivity. Furthermore, this study confirms that a supportive academic environment can accelerate the improvement of students' research skills, where the availability of facilities, effective mentorship, and access to scientific information play an important role in shaping a strong research culture. In addition, the results showed that students who participated in research-based learning more frequently had better analytical skills compared to students who engaged in research activities sporadically. The implementation of systematic and sustainable learning strategies is proven to be able to create a more critical and analytical scientific mindset. It was also found that research-based learning combined with hands-on mentoring was more effective than theory-based learning alone. This suggests that a hands-on approach to research is more likely to improve students' understanding and ability to apply the

scientific method. Furthermore, the use of technology in research learning has great potential to improve the efficiency and effectiveness of students' research process, which can be further developed through digital platforms and data analysis software. Thus, this study underscores that the synergy between research learning, madrasah support, and student engagement in the scientific community can be a major catalyst in improving student research productivity, as well as contribute to strengthening research capacity at the secondary education level.

The implication of this research is that madrasas need to strengthen the research curriculum, increase the capacity of mentor teachers, and expand collaboration networks with academic and industrial institutions. The implementation of research seminars and scientific publications also needs to be intensified so that students get more experience in disseminating their research results. This research contributes to the theoretical and practical realm in the field of research-based Islamic education. Theoretically, it provides empirical validation of a mediation model in which research-based learning acts as a bridge between institutional support and student research productivity, thereby expanding the constructivist learning framework in the context of madrasas. In practical terms, the study offers evidence-based recommendations for madrasah stakeholders, emphasizing the importance of improving pedagogical design, enhancing teachers' research capacity, and institutionalizing a research culture to encourage student inquiry. By identifying key mechanisms and interactions, this research supports policy efforts aimed at transforming madrassas into dynamic and research-oriented educational institutions. However, this research is not without limitations. The use of self-reported survey data can cause response bias, and this study is geographically limited to public madrassas in Jakarta, which can affect generalizations to other regions or types of madrasas. In addition, unmeasurable factors such as a student's socioeconomic status, parental support, or intrinsic motivation were not included in the model but could potentially influence the results. Future research should adopt a mixed-methods longitudinal design across different regions and integrate additional variables to build a more comprehensive understanding of how research-based learning operates in diverse educational settings.

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Author Contributions

Specify individual contributions using the following statements:

"Conceptualization, Farida Hanun is responsible for conceptualization, methodology, formal analysis, validation, and project administration. Onok Yayang Pamungkas contributes to conceptualization, methodology, formal analysis, and validation. Suprapto handles software, visualization, supervision, and fundraising. Wakhid Kozin is involved in the validation process. Achmad Habibullah carried out an investigation. Lisa'diyah Ma'rifataini is responsible for the provision of resources."

All authors have read and agreed to the published version of the manuscript."

Conflicts of Interest

The authors declare no conflicts of interest.

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