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Connecting the Dots : How Research-Based Teaching Shapes Teacher Self-Efficacy and Elevates Professional Development in Education

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Abstract: This study aims to analyze the perception of implementing research-based teaching and teacher self-efficacy in improving professional teaching and learning. This study used a quantitative approach with the survey as a data collection method. 187 teachers were involved in the study spread across three different provincial regions. Data collection was conducted using questionnaires related to teachers' perceptions and self-assessments of research-based teaching, teacher self-efficacy, and professional teaching and learning. The analysis used a two-step approach involving measurement and structural model using structural equation modeling (SEM) analysis. The results showed that research-based teaching has an assential role in improving professional teaching and learning. In addition, teacher self-efficacy also affects the development of teaching and learning professionals, indicating that teacher confidence in their teaching ability has a significant impact on the quality of student learning. The use of research-based teaching by teachers not only increases the efficacy of their teaching, but also positively impacts the learning experience of students, enriching and expanding the quality of learning.

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Introduction

Increasing international attention to research-based teacher education has sparked diverse national initiatives aimed at leveraging research within the realm of education (Lundqvist &; Westerlund, 2022). However, students of teacher education programs are faced with the challenge of lacking the knowledge and skills necessary to manage, analyze, and interpret research data (Mishore &; Abate, 2023). Learning experiences during teacher education programs require pre-service students to make classroom management plans based on theoretical and empirical studies (Davis et al., 2023). In particular, an approach that integrates theory and practice in a hierarchical manner is needed to improve the quality of traditional teaching and direct it towards more modern learning patterns (Gratani et al., 2023). Reforms in education demand strong commitment and teacher quality improvement as a very important investment to improve the overall quality of education (Kneen et al., 2023). In today's educational context, teachers have taken advantage of a variety of digital tools to deliver lesson materials and encourage more active interaction with students. These efforts not only deepen their understanding of learning design, but also support the development of empathic attitudes towards students (González et al., 2023).

In an effort to achieve learning effectiveness, several key factors that need to be considered by teachers, such as subject integration, implementation of pedagogical design, analysis of student learning difficulties, and self-efficacy, need special attention (Karpudewan et al., 2023). On the other hand, the enrollment of prospective teachers at state universities is an important factor, given that teaching is regarded as the second least preferred career option

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in Indonesia (Suryani et al., 2016). Enhancing the quality of teacher education in Indonesia demands comprehensive institutional reforms, encompassing stringent qualification criteria and heightened standards to elevate the overall teaching proficiency effectively within the academic domain (Irnidayanti & Fadhilah, 2023). Through an investigative study of teacher education in Ethiopia, a significant gap was revealed between the field knowledge of prospective teachers acquired during education and the expectations of the knowledge they should have in accordance with the existing curriculum (Alemu et al., 2021) Therefore, the importance of alignment between curriculum standards and teaching practices carried out by teachers is a highlight that cannot be ignored because this affects the effectiveness of student teaching and learning (Yang, 2022) Teacher education should be more supportive of implementing these practices in a broader teaching context to ensure a more holistic learning experience (Young & Young, 2023) The development of concepts in the teacher education curriculum involves many complex factors, such as preferences that may be reflected in attributes of professional identity and experience in education (Drenoyianni & Bekos, 2023).

In the midst of the advancement of digital era education influenced by advanced technology such as artificial intelligence and the internet, learning will become more adaptive and individualized, tailored to the individual needs of learners (Ally, 2019) Teachers can apply the principle of connectivity in creating an engaging digital learning environment. This allows learners to better understand the concept of sustainability through online interaction as well as access to digital knowledge sources (Dziubaniuk et al., 2023). However, teachers face challenges in designing long-term learning programs and setting individualized learning goals due to fundamental curriculum changes and principles (Pham et al., 2023). Reform of the teacher education curriculum is important to emphasize a deeper study of poverty alleviation and its relationship to racial differences (Milner &; Laughter, 2015). Life skills and skill integration are values in education that need to be integrated into the curriculum, as well as earnest efforts to be able to apply these values to the student learning experience (Süer & Demirkol, 2023). The urgency of the importance of prospective teacher experience in shaping their professional knowledge and skills can be achieved by integrating teaching experience into the teacher education curriculum (Ross &; Chan, 2023)

Teacher education programs need to enable a balanced integration of theory and practice for educators and prospective teachers, leveraging research products and processes to improve teaching effectiveness both in the campus environment and in practical experiences in schools (Wang et al., 2023; Zaragoza et al., 2023). Other studies highlight trending focus on technology-assisted learning, task design, and task evaluation in teacher education programs (Jia &; Bava Harji, 2023), while research-based teacher education approaches have the potential to help teachers develop confidence and competence in their pedagogical practices (Lim, 2023). In addition, other studies have shown that inquiry-based teaching through the use of research results as an implication of theoretical studies may be more efficient than traditional methods in improving students' knowledge acquisition (Kožuchová et al., 2023). However, superficial understanding and ineffective implementation of education policies by stakeholders, such as lecturers, contribute to the quality of teacher education in Malawi (Ed, 2023).

The results of several studies highlight important aspects in the preparation and formation of teacher candidates. (Kakazu &; Kobayashi, 2023) assert that early experience in school can help prospective teacher students realize the need for knowledge and skills essential in becoming an educator, both from a practical and theoretical point of view learned at university. In this regard, (Li & Xue, 2023) propose a 'new normal' in teacher education guided by industry needs, which requires reform of the teacher certification system,

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development of a comprehensive teacher education curriculum, changes in teaching content and methods, as well as improved overall effectiveness. In addition, the importance of acknowledging and incorporating the experiences of prospective teachers into the teacher education curriculum is highlighted by (Ross &; Chan, 2023), emphasizing that these experiences play a role in the formation of their knowledge. (Evagorou et al., 2023) shows that students highlight the relevance of curriculum to everyday life, affirming that curricula connected to the context of their lives are more meaningful.

In addition, (de Almeida &; Viana, 2023) highlight the difficulties faced by teachers in their roles as curriculum designers, pointing out that the lack of specific knowledge and skills is an obstacle in implementing collaborative curriculum design. Collectively, these analyses underscore the complexity, challenges, and importance of the experience and knowledge required in the preparation and implementation of teacher education curricula. Several studies related to research-based teaching and its implications in learning practices have been carried out, including limited to education (Hanks, 2019; Joseph-Richard et al., 2021; Zhou & Ye, 2023) and there are still many student research projects that do not contribute outside the classroom (Wagge et al., 2022) Research related to the application of research results in learning practices is still small, so further studies are needed to see further relationships (Costa & Broietti, 2021). To bridge the gap between theoretical and empirical studies above, this study aims to analyze the perception of implementation of research-based teaching and teacher self-efficacy in improving professional teaching and learning.

Research Method

This study was a quantitative research approach utilizing a survey technique to describe and and verify the interrelation of variables. The population in this study consists of teachers distributed across three different provinces in the eastern, central and western regions of Indonesia. The selection of data collection locations was made to capture a more diverse range of perceptions and self-assessments regarding the variables under investigation. The sampling technique used is simple random sampling with the characteristics in Table 1 below.

Table 1. Respondent Profile

		Absolute frequency	Percentage (%)
Gender	Male	62	33,5
	Female	123	66,5
Education Level	Bachelor	142	76,8
	Master	40	21,6
	Doctor	3	1,6
The Experience of Teaching	0 - 1 Years	16	8,6
	1 - 5 Years	84	45,4
	5 - 10 Years	37	20
	10 – 15 Years	21	11,4
	> 15 Years	27	14,6
The Age	20 – 30 Years	77	41,6
	31 – 40 Years	63	34,1
	41 – 50 Years	27	14,6
	51 – 60 Years	16	8,6

Data collection was conducted using questionnaires related to teachers' perceptions and self-assessment of research-based teaching, teacher self-efficacy and professional teaching and learning, a literature review was carried out based on theories and previous research results such as (Hanne Tack Ainat Guberman & Vanderlinde, 2023; Heikkilä et al., 2023; Maddens et al., 2021; McConnell et al., 2023). The results of the analysis of this

literature review define the manifest research-based teaching into several measurement constructs about the profile or characteristics of research-based teaching including: 1) the use of research sources, 2) research analysis, 3) the use of data, 4) professional development. The perception and self-assessment of teaching and learning practice measurement construct adopts (Yenen, 2021) which consists of: 1) Planning of education and teaching, 2) Creating learning environments, 3) Managing the teaching and learning process, 4) Assessment and evaluation. The variable teacher self-efficacy adopts from several literatures such as (Asare & Amo, 2023; Lu et al., 2020; Pressley & Rangel, 2023), which consists of self-efficacy in classroom management, instructional design, student engagement, differentiated instruction, and providing feedback. So that the analysis of the hypothesis model used is as follows in Figure 1:

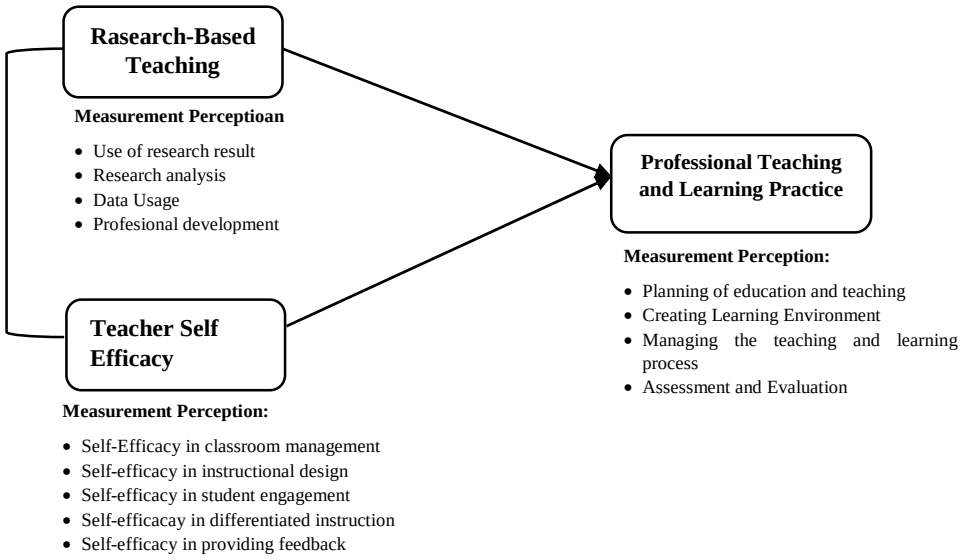

Figure 1. Hypothesis framework

Structural equation model (SEM) modeling analysis is used to determine predictor research-based teaching and teacher self-efficacy of professional teaching and learning with modifications based on previous theoretical and research studies. In determining the relationship of the built model, structural model analysis is needed (Hair et al., 2017) through AMOS 24 software.

Results and Discussion

Analysis of the results of the study begins by analyzing the reality and validity of the constructs used as presented in Table 2, the alpha and composite reality (CR) Cronbach scores, which are measures of the reliability and internal consistency of the measurement construction, are all above the minimum score of 0.6 (Hair et al., 2017).

Table 2. Validity and reliability measures

Construct	Item Codes	Mean Score	Standard Deviation	Factor Loading	AVE[a]	Cronbach's Alpha	CR[a]
Research-Based Teaching (RK)	RK_1	8.90	0.876	0.659	0.523	0.800	0.813
	RK_2	8.67	0.917	0.716			
	RK_3	13.05	1.404	0.804			
	RK_4	8.94	0.981	0.708			
Teacher Self-Efficacy (TE)	TE_1	4.32	0.583	0.707	0.627	0.895	0.893
	TE_2	4.30	0.545	0.820			
	TE_3	4.35	0.499	0.827			
	TE_4	4.35	0.531	0.834			

	TE_5	4.35	0.510	0.766			
Professional Teaching and Learning Practice (PTL)	PTL_1	8.63	0.975	0.744	0.670	0.819	0.889
	PTL_2	8.70	0.957	0.767			
	PTL_3	21.41	2.432	0.906			
	PTL_4	8.50	1.024	0.847			

Table 2 above shows that the measurement constructs used show strong internal consistency reliability, as well as good correlation between items intended to measure the same construct. Furthermore, construct validity is determined by evaluating the convergent and discriminant validity as recommended by (Hair et al, 2017). As shown in Table 2, the factor load for each survey question/item and its mean variance extracted for each construct (AVE) are greater than the recommended minimum value of 0.5 each. Therefore, this shows that the discriminants and convergent validity conditions of our model are met. Hence, their constructs and items can be said to be valid and reliable.

By referring to the construct validity and reliability test data above, the determination of the measurement model and structural model assessment is carried out. This involves determining the coefficient of determination and the significance of the path coefficient (Hair et al., 2017), as presented in Figure 2 of the following structural model:

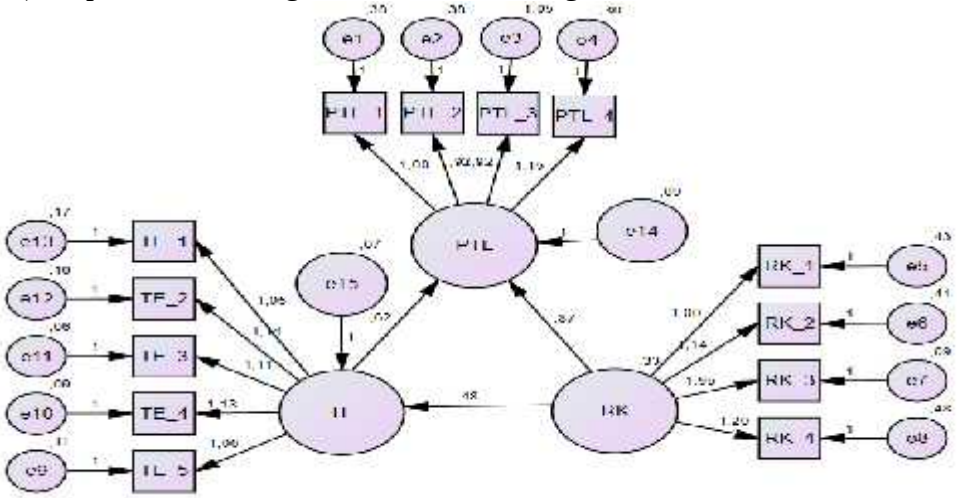

Figure 2. Structural measurement model

Before proceeding with this analysis, the model was assessed to ensure there were no collinearity issues (Hair et al., 2017). To confirm the good fit of the model, all indices must meet the statistical criteria used, as presented in Table 3 below:

Table 3. Goodness of Fit

GoF Indices	Criteria	Estimates	Fitness
Chi-Square	Small value	$\chi 2$ = 74,304	*Good fit*
P	P > 0.05	0,136	*Good fit*
NCP	Small value	12,304	*Good fit*
RMSEA	<0.08	0,033	*Good fit*
ECVI	Small value and close to saturated ECVI	D : 0,719 S : 0,989 I : 8,781	*Good fit*
AIC	Small value and close to saturated AIC	D: 132,304 S : 210,000 I :881,387	*Good fit*
CAIC	Small value and close to saturated CAIC	D ; 269,398 S :595,647 I : 932,802	*Good fit*

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GoF Indices	Criteria	Estimates	Fitness
CMIN	<2,0	1,198	*Good fit*
GFI	>0,9	0,943	*Good fit*
AGFI	>0,9	0,917	*Good fit*
TLI	>0,95	0,990	*Good fit*
CFI	>0,95	0,992	*Good fit*
IFI	>0,9	0,992	*Good fit*
NFI	>0,9	0,953	*Good fit*

In general, based on Table 3 above, it is stated that the suitability of the model indicates that it can produce data and that it is consistent with the data. Furthermore, analysis was carried out to test hypothesis on the model used, as presented in Table 4 below:

Table 4. Hypothesis Test

Hypothesis way				C.R.	P	Result
H^1	Research-Based Teaching	→	Teaching Efficacy	7,134	***	Accepted
H^2	Teaching Efficacy	→	Professional Teaching and Learning	3,858	***	Accepted
H^3	Research-Based Teaching	→	Professional Teaching and Learning	6,295	***	Accepted

Note: *** < 0,001

Based on Table 4 above, with CR value criteria of 1.98 and P Value < 0.05, it is known that hypothesis 1 (H1) research-based teaching affects teaching efficacy with a CR value of 7.134 and a P Value <0.001. This explains that research-based teaching plays an important role in increasing teacher efficacy in teaching. Hypothesis 2 (H2) explains that teaching efficacy has a positive and significant effect on professional teaching and learning, which is characterized by a CR value of 3.858 and a P Value <0.001 ; this explains that teachers who trust their ability to teach effectively tend to create more meaningful and productive learning experiences for their students. Hypothesis 3 (H3) states that research-based teaching has a positive and significant effect on professional teaching and learning, marked by a CR value of 6.295 and a P Value of < 0.001. It explains that teachers who have access to and understand research-based knowledge are more likely to adopt best practices in teaching and learning. They can integrate the latest research findings into their teaching methods, resulting in a more effective learning experience.

Discussion

The results of this study state that research-based teaching has a positive and significant influence on teacher self-efficacy and professional teaching and learning. Research-based teaching affects professional teaching and learning in line with research (Andrews et al., 2022; Zaragoza et al., 2023) The construct of research-based teaching variables that affect the construct of professional teaching and learning consists of several measurement manifests including 1) use of research results, 2) research analysis, 3) data usage, 4) professional development. This is in line with previous research according to. Manifest use of the result has a loading factor of 0.659, which explains that the use of research studies implemented in teaching practice can have a positive and significant influence on teachers' professional development. The use of research results in learning practice can be done by teachers through scientific journals or articles that are widely available as open access educational resources. However, on the other hand (Heck et al., 2020) in their research state that as many as 60% of educators do not use open educational resources, and many have never even heard of them. The use of open educational resources

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can be packaged, such as in the form of workshops, online tutorials or other resources that can increase teacher capacity in learning practices (Caduff et al., 2023)

Manifest research analysis has a loading factor of 0.716 for professional teaching and learning ; this explains that the use of research analysis in teaching and learning helps create a higher-quality educational environment. Research analysis of academic manuscripts, scientific journals or research results encourages educators to become professionals and continue to learn and adapt to the dynamics of education. Scientific journals as a means that play an important role in the construction, dissemination and use of scientific knowledge in various fields (ERGİN et al., 2023). Research analysis helps teachers to be able to integrate research into learning practices (McConnell et al., 2023). Manifest data usage has a loading factor of 0.804 for professional teaching and learning. This explains that through research data, teachers are able to identify student needs, evaluate the success of learning programs and make decisions based on scientific evidence to develop professional teaching and learning. The data obtained from the study of research results will help teachers to be able to make the right decisions in order to create effective teacher learning (Ley et al., 2023) In general, the use of data in a study is able to evaluate policy effectiveness and formulate better policies in the future (Abramo & D'Angelo, 2023).

Professional development has a loading factor of 0.708. This explains that teacher professional development can be developed through a series of trainings, seminars, conferences, and reading the latest literature to stay connected with the development of knowledge in education. Professional development development leads to the development of contemporary pedagogy strategies that promote experiential and constructivist learning (Cotronei-Baird et al., 2023). Teacher professional development in the aspects of online and blended learning is also a focus in today's digital era (Uribe-Banda et al., 2023) Integrating ICT in teacher professional development needs to pay attention to socio-emotional aspects, technical competencies, and innovative teaching strategies or techniques (Lo & to, 2023) The application of scientific research results into teaching practice can expand a teacher's knowledge and professional skills (Lin & Liu, 2023) In addition, environmental factors and collaborative professional development programs may be designed to enhance a thorough understanding of pedagogical principles (Moy et al., 2023) Geographic location differences, such as rural, urban, and suburban, have different levels of professionalism, especially in their integration of technology in learning (Kormos & Wisdom, 2023)

Self-efficacy in classroom management has a loading factor of 0.707 for professional teaching and learning. The concept of teaching and learning from a constructivist perspective will have an impact on increasing self-efficacy in higher classroom management, because it has good pedagogical content knowledge (Shen et al., 2023). Professional ability and self-efficacy will be a provision for teachers to improve their professionalism to create teacher-centered learning (Smith et al., 2023). Teacher self-efficacy is an important factor in future teaching practices and is related to teacher effectiveness and student learning (Naidoo (Naidoo & Naidoo, 2023). In teacher education programs, most prospective teachers in practicum have a number of concerns and anxieties that can reduce self-efficacy and have an impact on their performance (Gorospe, 2022). The loading factor in creating a learning environment is 0.767 ; this states that through knowledge from research results, teachers can create a learning environment that improves students' thinking skills. Research program-based courses can contribute to encouraging student knowledge and experience in the field of pedagogy needed in learning (Frankowski, 2021)

The application of research-driven teaching greatly influences teachers, learning methodologies, and the formulation of educational policies, both in theory and in practice.

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Conceptually, teachers are required to utilize teaching and learning methods based on research results when planning, implementing, and evaluating the teaching process (Geletu &; Adige, 2023). Teachers do not only rely on intuition or experience, but use research findings to be implemented in classroom learning practices. The application of research-based teaching can also substantially improve research capabilities (Thiem et al., 2023). In addition, research-based teaching also influences teachers' self-efficacy, reinforcing their belief in the ability to change student learning outcomes based on empirical evidence, which directly affects their motivation and performance in the classroom. Teachers need to have high confidence in their abilities and actively engage in research to improve the professionalism and quality of teaching. This is important so that they can use research findings to address classroom challenges, student needs, and instructional improvements (Tekin, 2023). The lack of teacher involvement in educational research is generally caused by limited time, opportunity, and lack of work environment support for research activities (Anna Koski, Mikko Puustinen &; Salminen, 2023).

Curriculum refinement in teacher education programs is needed so that prospective teacher students acquire high-level knowledge, such as procedural and epistemic knowledge, needed in completing research projects and improving problem-solving skills (Mishore &; Abate, 2023). In addition, professional development rooted in bottom-up, collaborative, context-specific, and integrated perspectives in teacher tasks is essential (Bergmark, 2023). From a practical perspective, this research-based teaching approach encourages the continuous professional development of teachers. The provision of adequate resources for teaching and research is necessary, and the roles of teaching and research should be seen as complementary (Raimo Kaasila &; Uitto, 2023). In addition, teachers not only focus on one-time learning but also constantly update their knowledge by studying the latest findings in educational research. They also tend to adopt best practices backed by research evidence, improving the quality of teaching and learning in the classroom. The adoption of this practice also encourages better student learning by presenting material more effectively and paying attention to various student learning styles. Teachers who adopt a student-focused approach generally apply methods that involve students in research activities as well as academic environments (Blomster et al., 2014)

Conclusion

The results showed that there is a significant relationship between research-based knowledge and teaching efficacy, which provides an understanding that this knowledge has a central role in improving teachers' ability to teach. Furthermore, teaching efficacy has also been shown to influence professional learning experiences with students, indicating that teachers' confidence in their teaching abilities has a meaningful impact on the quality and meaning of student learning. Other findings confirm that teachers who have a deep understanding of research-based knowledge tend to adopt best practices in the teaching and learning process, which in turn creates more effective and meaningful learning experiences for students. Thus, the main conclusion is that teachers' use of research-based knowledge not only increases their teaching efficacy but also leads to a better and more productive learning experience for students.

Recommendation

The recommendation is intended for various stakeholders in the field of education, including policymakers at the Ministry of Education, school principals, and teachers. Its aim is to provide specific guidance for policymakers in designing a comprehensive coaching program needed to expand research-based knowledge for teachers and support the development of

teaching skills through inclusive training. For school principals, it serves as a guide to creating an environment that fosters the integration of research knowledge into daily teaching practices and facilitates information exchange among teachers, researchers, and practitioners. For teachers, this recommendation offers guidance on developing teaching skills based on research knowledge and emphasizes the importance of continuous evaluation of student learning experiences, which is also important in continuing to improve the education system. In the development of future education policies, the concept of research-based teaching can serve as a robust foundation. The integration of research in education policies ensures that every decision made is grounded in solid scientific evidence. This impacts the development of curricula that are more evidence-based and responsive to changes in education. Additionally, support for educators to access the latest research information and in their professional development also becomes a focal point of future policies.

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